

Final Report

A Shannon Agile Logistics Hub and Atlantic Arc
Network: Rationale and Development Guidelines

John D. Kasarda, Ph.D.
Director
Kenan Institute of Private Enterprise
The University of North Carolina at Chapel Hill
Chapel Hill, North Carolina 27599
U.S.A.
Email: john_kasarda@unc.edu

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Executive Summary

Ireland is competing in a new economic era in which global sourcing and exporting and speed of production and delivery are becoming critical to commercial success. This new era is being spawned by three irreversible factors: 1) the globalization of business transactions; 2) the shift to just-in-time sourcing, manufacturing, and distribution; and 3) the growing need of many 21st century export industries to ship by air to meet time demands of distant customers.

Corresponding to these changes is an emergence of a new competitive environment where price and quality are necessary but no longer sufficient for commercial success. Increasingly, time-to-market and agile response are assuming essential roles, as well. Customers from both advanced and emerging markets are demanding fast and reliable delivery of products often with distinctive and personalized features. Competitive advantage is being gained by those firms that respond flexibly and rapidly to such opportunities and deliver quality parts, components, and manufactured products quickly and efficiently to regional and global customers.

To meet these needs, an agile logistics hub (ALH) at Shannon International Airport is proposed to cornerstone and drive a multimodal logistical system throughout Western Ireland's Atlantic Arc region, from Donegal to Wexford. The Shannon ALH and Atlantic Arc logistics system will be designed and developed to promote connectivity, speed and agility along the entire regional supply chain. Once orders are placed, parts and components will be acquired regionally via surface transportation and by cargo planes from more distant locations. Manufacturers will quickly assemble products and deliver them to international markets, frequently via airfreight. The ALH will feature express customs clearance procedures, modern materials handling systems, and facilities to speed international sourcing and exporting processes. It will also have state-of-the-art intermodal and electronic data interchange (EDI)

technologies that will substantially accelerate materials handling and transfers among factories, distribution facilities, aircraft, trucks, rail cars, and ships, thereby providing rapid global access and other significant competitive advantages to businesses and industries located throughout the Atlantic Arc region.

Upgraded regional highways and new and extended rail lines will be required to more efficiently integrate the ALH with Atlantic Arc cities other regional business clusters, and the Western and Southern Irish seaports, if the proposed regional agile logistics system is to achieve its full development potential. Likewise, state-of-the-art broadband, fiber optic loops, and satellite uplinks and downlinks will be required for the region's goods-producing firms to trace, track, and control product movements, which in the future will increasingly be monitored through RFID (radio frequency identification) and GPS (global positioning systems).

The Shannon ALH will be the multimodal interface, driver, and integrator of the Atlantic Arc logistical system. If it is to achieve the competitive benefits noted above, and serve as a magnet for global manufacturers, assemblers, and distributors, its planning and development must not only incorporate 21st century logistics infrastructure and business practices but also initiate aviation policy changes such as "open skies" for cargo aircraft and change of gauge rights. The study discusses these needs and presents guidelines for both infrastructure development required for a Shannon ALH and the appropriate business and aviation environment that must be created.

The study commences with a summary of the business rationale for a Shannon ALH and regional logistics system. This includes contemporary competitive forces shaping production and distribution and how airport-centered logistics hubs in the U.S. and Asia have harnessed these forces for development advantage. Such development has attracted numerous growth

industries to the airport environs. Clusters and spines of airport-linked businesses have likewise located along major surface transportation corridors to the airports giving rise to a new urban form -- the *aerotropolis* --stretching as much as 30 kilometers from the airports.

It is concluded that Shannon has a unique opportunity to drive similar development outcomes if it puts in place the logistical infrastructure, business environment, and aviation policies required to provide unmatched speed and agility in European airport materials handling and distribution. This new logistics strategy would build on the region's existing assets including moderate costs, a well-educated workforce, English-language skills, prime location in the American-European air transport nexus, and knowledge-based business development policies that contributed to the region's "Celtic Tiger" growth in the 1990s.

Following an introductory chapter covering the above issues, three chapters offer, in order, the infrastructure, business plan, and implementation plan guidelines to design, develop, operate, and manage an agile logistics hub at Shannon International Airport and generate the greatest region-wide economic impact. Critical success factors are presented, as well as target industries specified. To attract newer, high growth, high value-adding industries, it is stressed that the relative importance of traditional promotional privileges and investments incentives by government will be superseded by logistical capabilities of the site and quick and efficient access to global suppliers and customers.

The fourth chapter concludes with 30 recommendations and action steps to be followed by public sector agencies responsible for Shannon Airport and both the Shannon and greater Atlantic Arc regions to successfully develop the ALH and regional logistics network. Those recommendations and action steps focus on required hard and soft infrastructure as well as the business and

aviation policy strategies to be pursued to provide connectivity, speed, and agility to Atlantic Arc firms: the three emphasized factors for their gaining competitive advantage in the 21st century. The recommendations also address infrastructure and facility phasing and marketing strategies along with the public and private sector options for developing, operating, and managing the Shannon ALH.

Apropos the latter, it is recommended that a special Shannon ALH Authority be established made up of regional public and private-sector leaders. This organization would have the responsibility to initiate, control and coordinate all planning, infrastructure development and facility construction to ensure effective and timely completion of the project. The Authority would assess and determine the most efficient way to finance, build, operate, and manage the ALH in terms of public and private enterprise participation. It would prepare all Terms of Reference; draft bid and tender documents; market procurement opportunities; select all consultants and monitor their work, and help recruit private-sector tenants and users of the ALH. The Shannon ALH Authority would also coordinate closely with all Shannon regional and greater Atlantic Arc government and business leaders on ALH development and associated logistical infrastructure and commercial development throughout the region.

Chapter 1

Regional Challenges and Strategic Response: The Agile Logistics Hub/Aerotropolis Potential

I. Introduction

Ireland and its Atlantic Arc region are at an economic crossroads. Strategic decisions and development initiatives taken today will determine the 21st century direction the country and region go in terms of industrial mix, business competitiveness, job creation, and citizen quality of life.

Critical issues are at stake. Will the Atlantic Arc region in the West of Ireland, from Donegal to Wexford (see Exhibit 1.1), continue to successfully diversify into “new economy” high-tech, R&D, and information-intensive business services sectors? Will both its traditional manufacturing and emerging high-tech and white-collar service industries be able to compete effectively, domestically and worldwide, in the new knowledge-based, speed-driven marketplace? Will the region’s job creation over the coming decade match that in quantity and quality of the last decade of the 20th century, when it (and all of Ireland) were attracting substantial amounts of inward investment and generating substantial new quality employment? Or, will it resemble more the 1970s and 1980s, when the region’s chief export was its well-educated, well-trained workforce? Finally, will commercial physical development in the region be spatially efficient, attractive, and environmentally sustainable, becoming an enduring magnet for new economy knowledge-based workers, tourists, and long-term residents alike?

All these issues, of course, are inextricably interwoven. Taken together, they will determine the economic fate of the west of Ireland. It is therefore imperative that they be addressed with both strategic vision and coordinated

action. This requires, first, a solid understanding of the new drivers of 21st century industrial competitiveness, job creation, and economic development. Second, regional government and business leaders, in partnership, must implement an integrated set of strategies, policies, and programs to harness and leverage these new competitive drivers to the region's and to the entire country's commercial advantage.

Apropos the above, it is already clear that an increasingly fast-paced, globally networked economy is changing the rules of industrial competition and business 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 mantra of many of the world's most successful firms.

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

As more and more air travel intensive-businesses cluster near major airports and along transportation corridors radiating from them, a new urban form is emerging – the Aerotropolis – stretching up to 25 kilometers outward from the airports. With the airport serving as a multimodal transportation and

logistics nexus, strings and clusters of business and technology parks, industrial parks, distribution centers, information and communications technology (ICT) complexes and tourist attractions are forming around the airports and along connecting surface transportation corridors. Even cities and development zones located as far as 60-90 minutes drive from some U.S. and Asian airports are experiencing accelerated economic growth as will be documented later.

Such development is occurring because of the connectivity and accessibility advantages gateway airports (especially these that have developed as multimodal agile logistics hubs) provide to business and business people in the new speed-driven, globally networked economy. For nearly four decades, Shannon International Airport provided such connectivity and accessibility, without which much of the inward investment to the airport area and the region would not likely have taken place. This connectivity (especially that to the U.S., its primary market and contributor of foreign direct investment) is being challenged by increased dominance of Dublin and other aviation hubs in Western Europe, by evolving EU aviation policies and by limited successes thus far in developing Shannon International Airport and its immediate environs into a world class agile logistics hub. As will be pointed out shortly, new low-cost competitors in Asia (especially China) and Eastern Europe are pulling jobs away.

The pending break-up of Aer Rianta (the Dublin-based organization that manages Shannon and Ireland's two other major airports) will provide Shannon International Airport with an opportunity to shape its own destiny and, in partnership with government, academic, and business leadership of the greater Atlantic Arc region, a much broader economic destiny. I will return to this propitious opportunity in a moment. Before doing so, however, I would like to comment on fundamental strategies being followed by Shannon Development, the largest and most important economic development organization in the Atlantic Arc region.

II. Shannon Development Strategies

Shannon Development brands itself around its action theme “Pioneering Regional Development for the Knowledge Age.” The company recognized years ago that the Shannon region could no longer compete simply on lower wages and investor incentives, but that success in the 21st century required innovative partnerships among academia, business and government to develop intellectual capital and knowledge-based business infrastructure. This was a farsighted decision, without which many of the new economy firms attracted to the greater Shannon region over the past decade would not have occurred. And, given the rising attractiveness of China, Eastern Europe and other low-wage locations for routine manufacturing, it is likely that the recent dip in regional employment would have been much worse.

The corporate strategy takes into account global, European, national, and local and regional assets and trends in shaping its development initiatives. These initiatives are further guided by its vision of regional competitiveness and sustainable development, resting on five key elements/building blocks that it believes must be achieved to realize the vision: connectivity, knowledge, world-class places and products, enterprise and living (see Exhibit 1.2). The company has specified benchmarks and milestones for each element/building block, along with measures of success. In line with the National Development Plan 2002–2006 and the National Spatial Strategy 2002, the company focuses on job creation, international competitiveness, and balanced development within the region and between the region and the rest of Ireland, the Dublin area in particular. Its most recent strategic focus has been on (1) new enterprise development, especially those with high job growth potential, (2) pioneering regional initiatives to position the region to compete with the growing strength of the Dublin/Mid East Region and drive future development, including, among others, the Shannon Development Knowledge Network cornerstoned by five technology centers,

e-infrastructure, e-towns, and improved transportation infrastructure, and (3) tourism promotion and development based on action programs to give this sector a substantial boost.

Shannon Development has been continuously assessing its strategic actions as they impact job creation, inward investment, business productivity, and exports of the region's indigenous and foreign-owned firms, as well as better development balance within the Atlantic Arc region and with the Greater Dublin area. Based on this assessment and consultation with Atlantic Arc regional leadership and others, the company has concluded that substantially improved results in these arenas will require a new economic engine to catalyze and accelerate sustainable economic development throughout the region. The engine being considered is an agile logistics hub at Shannon International Airport that will cornerstone and drive an agile logistics network for the whole of Western Ireland.

The next section will describe the competitive logic of an agile logistics hub at Shannon International Airport and an associated agile logistics network for the greater Atlantic Arc region. Under the rubric of *aerotropolis*, I will then summarize the evolution of airport-driven development at and around selected airports in the U.S. and Asia noting their competitive attributes, industry attractions, effects on jobs and exports, and impact on urban form.

Implications and recommendations for a Shannon agile logistics hub and extended regional logistics network will be provided, including its potential to attract new economy industries, foster economic development throughout Ireland's Atlantic Arc and to boost the competitiveness of the region's existing businesses and industries. This introductory chapter will serve as the basis of specifying the primary infrastructure, business plan, and implementation plan guidelines for the successful development of a Shannon agile logistics hub and greater regional network that will be provided in Chapter 2, 3, and 4.

III. Competitive Logic for an Agile Logistics Hub and Regional Network

With increased global competition and rapidly evolving markets, substantial changes are occurring in the way business is being conducted around the world. At the forefront is the emergence of a new commercial environment where price and quality are necessary – but not sufficient – for competitive success. Increasingly, customers from both established and developing markets are demanding fast and reliable delivery of products often with distinctive, customized features. An industrial advantage is being gained by firms that respond flexibly and rapidly to their domestic and global customers, delivering lower cost, high-quality products quickly and efficiently.

Staying on top of the industrial competition also requires more efficient global supply-chain management. Manufacturers must be able to access regional and global networks of suppliers of raw materials, components and sub-assemblers in order to obtain the best-quality products at the lowest possible price. At the same time, increased flows of information worldwide are leading to faster changes in market demands. Companies that can detect these changes, design and produce the desired products, and deliver them more quickly than other producers will capture the market. Since speed also reduces warehousing and inventory costs, stock-outs and remaindered goods, the speed advantage becomes a cost advantage as well.

The speed advantage 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 and the computer software industry where delivery time to the retail shelf (or

now directly to the retail customer) frequently separates market winners from losers.

The implications of these trends for new logistics strategies are already evident. Adapting to growing global demands for flexibility and speed, companies such as Acer, Benneton, Boeing, Dell, General Electric, IBM, Nokia, Siemens, Toyota, and Wal-Mart are reengineering their sourcing, production 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 (1) concept-to-cash cycle time, (2) flexibility, (3) speedy, reliable delivery, and (4) after-sales support (or return) of their products. They manage complex international networks that encompass the entire value chain of suppliers, distributors, and customers across national borders, with speed and agility 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 information, 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 global supply chain management and quick response. It is becoming increasingly clear that new strategies capable of meeting these challenges will require the development of new agile logistics infrastructures which synthesize information and transportation to speed the delivery of materials and goods from suppliers to manufacturers and from manufacturers to customers, 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. Socialist, and former socialist countries such as China, Russia and Poland 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 distribution. With rising workforce skills and rapid cross-border technology transfer, what were previously known as Third World countries in Asia and Latin America have achieved much higher levels of output and now produce sophisticated goods and services.

International customers (including those in India, China, Eastern Europe, and Latin America, which many believe pose the best long-term markets for Ireland) 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, reliability, and competitive pricing. 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.

IV. E-Commerce and Speed-Based Supply-Chain Management

The rise of e-commerce further heightened time-based competition. As late as 1995, sales through the Internet were essentially zero. By 1999, U.S. Internet-based business-to-consumer (B2C) sales had grown to nearly \$7 billion, skyrocketing to \$46 billion in 2002 (U.S. Department of Commerce, 2003). According to Forrester Research, 166 million packages were shipped in 1999 by Internet retailers (e-tailers), with approximately 70 percent going by expedited delivery (Gose, 2000). By this year (2003), e-tailers are expected to ship 1.1 billion packages annually, with overall global e-commerce approaching \$7 *trillion* in transactions in 2006 (Forrester Research, 2001). Despite the death of thousands of dot.coms between 2000 and 2003, 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 (2001) predicts that e-marketplaces will account for up to two-thirds of B2B supply-chain transactions by 2006, predicated on industry, capturing 42 percent of online industrial trade and an average 28 percent of all business to business trade. Many suggest that with the simultaneous introduction of Enterprise Resource Planning (ERP), these e-figures could go even higher.

The expansion of the B2C e-commerce and direct-to-customer Internet orders has placed a particular premium on speed and reliability in the delivery process. To meet the imperatives of speed and reliability in order fulfillment, e-commerce distribution centers were built near gateway airports that have extensive flight networks, a location trend that's sure to accelerate in the decades ahead. This is especially the case at major air express hubs such as Louisville (UPS), Memphis International (FedEx), and Cincinnati (DHL) in the United States. Air express hubs actually extend the business day for e-commerce fulfillment by allowing shippers to take orders for next day delivery as late as midnight. Dozens of e-tailers have thus already located their fulfillment centers near Memphis International Airport to leverage the FedEx air express network. The same story holds for Louisville International Airport and Ontario, California where numerous companies have also sited e-commerce fulfillment centers near these UPS 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 computers and mobile phones. The clustering of such time-critical goods facilities around airports (often within air logistics parks), is stimulating further expansion of air cargo, air express, less-than-load (LTL) trucking, freight forwarders, and third party logistics providers (3PLs) along major arteries leading into and out of gateway 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. Forty percent of the value of world trade now goes by air, and the percentage is steadily rising (MergeGlobal, 2002). Air logistics, which represented a US\$ 250 billion industry in 2002, is expected to triple in the next 15 years while international air-express shipments are expecting to increase at least five-fold during this period (Boeing Company, 2003).

Already, air cargo and air express are the preferred modes of 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. (The global supply-chain model of Dell Computer, which pioneered this process in the early 1990s, is illustrated in Exhibit 1.3) Even lower value to weight B2B product distribution such as apparel, shoes and toys are becoming time-sensitive and increasingly shipped by air.

The rapidly growing importance of air commerce to Ireland's economy is illustrated in Exhibit 1.4. This exhibit shows Ireland's exports to the United States and imports from the United States, by transportation mode, weight and value, annually from 1990 to 2002. Observe that in terms of value, air exports rose nearly twenty-fold between 1990 and 2002, from slightly above US\$1 billion

to slightly above US\$20 billion, while air export weight increased four-fold from 9 million pounds to 36 million pounds. Ireland's merchandise imports from the U.S. also increased substantially between 1990 and 2002, though not as dramatically as its exports to the U.S. As a result of Shannon International Airport central business location, it handles 25 percent of Ireland's airfreight compared to just 10 percent of the country's passenger traffic.

V. Airports as Office, Commercial, and Professional Worker Magnets

Not only time-sensitive goods-processing and distribution facilities are being drawn to gateway airports. As the world's service economy also shifts into fast-forward, these airports are becoming magnets for regional corporate headquarters, trade representative offices, and professional associations that require officers 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. Business travelers benefit considerably from access to hub airports, which offer greater choice of flights and destinations, more frequent service, more flexibility in rescheduling.

The accessibility and travel flexibility hub airports offer have become essential to attracting business meetings and conventions, trade shows 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 2000, 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 US\$7.5 billion in wholesale transactions. It would be worthwhile for Shannon Development to explore developing a major merchandise mart and exhibition center since this is lacking in Ireland.

High-tech facilities (well-represented in the Shannon region) and airports also increasingly reinforce each other. With intellectual capital supplanting physical capital as the primary factor in wealth creation, time has taken on heightened importance for today's knowledge workers. So has the mobility of these workers over long distances. Research has shown that 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.

Others have suggested that prolonged global economic downturns exacerbated by catastrophic events such as 9/11 (New York World Trade Center attack) 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. Air

commerce and air travel should therefore be expected to rebound strongly from their 2001 to 2003 cyclical dip to record levels in the decade ahead.

VI. High-Tech and Urban Economic Impacts

Nowhere is this more the case than the centerpiece of the new economy – in the high-tech sector. With this sector’s supply-chains and employees increasingly geared to speed, mobility and global access, the availability frequent and extensive air service has become essential to the location of many information and communications technology (ICT) firms and other high-tech facilities. In the U.S., clusters of ICT and high-tech companies are thus locating along major airport corridors, such as those along the Washington, D.C. Dulles Airport access corridor in Northern Virginia and the expressways leading into and out of Chicago’s O’Hare International Airport. Dulles’s and O’Hare’s experiences are being replicated across the U.S., and throughout the world with centrality in global aviation networks becoming a primary predictor of an area’s high-tech job growth.

Regarding overall economic development, numerous studies from the U.S. and around the world document the remarkable impact of gateway airports on urban economies. To note just a sample:

- Los Angeles International Airport (LAX) is responsible for over 400,000 jobs in the five-country Los Angeles region; 80 percent of which are in LA County, where one in 20 jobs was found to be tied to LAX. The airport currently generates \$61 billion in regional economic activity, which translates to \$7 million per hour
- Dallas-Ft. Worth International Airport has become the primary driver of Metroplex’s fast-growing economy. The number of companies located within the dynamic Las Colinas area, just to the east of the airport, has

expanded to more than 2,000 and includes Abbott Laboratories, AT&T, Exxon, GTE, Hewlett-Packard, and Microsoft.

- In the 35-kilometer commercial corridor linking Washington, D.C.'s two major airports – Reagan National and Dulles International – employment grew from 50,000 in 1970 to over 800,000 by 2000. This represents a 1,500 percent increase: in contrast, overall U.S. suburban employment growth during this period was 61 percent. Among the companies located along the airport corridor are America Online, Computer Associates, Nextel Communications, Cisco Systems, and EDS.
- In the Philippines, Subic Bay Freeport is rapidly expanding around a former U.S. naval air base that was converted to commercial use in 1993. Since FedEx located its Asia/Pacific hub at Subic Bay in 1994, over 150 firms – employing 40,000 workers – have located there, generating almost \$2.5 billion in investment. Between 1995 and 2000 the annual value of exports from Subic Bay jumped from \$24 million in to \$559 million. 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 ICT and other high-tech manufacturing jobs, as UPS is growing its Asia air express hub there.
- Over 70 percent of the international firms in the region surrounding Amsterdam's Schiphol Airport cited their dependence on the airport as a primary reason for their location. The airport alone accounts for 1.9 percent of Netherland's GNP with forecasts indicating that by 2015, it will generate 2.8 percent – approximately \$14 billion.

The impact of airport-induced job growth on land use in the vicinity of airports is likewise substantial. An analysis of employment growth in the suburban rings of U.S. metropolitan areas showed that areas within four miles of airports added jobs two to five times faster than the overall job-growth rate of the suburban ring within which the airport was located (Weisbrod, Reed and Neuwirth, 1993). While most of the employment was concentrated around the airport or along major connecting highways within 15 to 20 minutes of the airport, recent research at Massachusetts Institute of Technology's International Center for Air Transportation documents that much broader region-wide impacts occur with air connections significantly facilitating a region's access to suppliers, markets, ideas and capital (EconSouth, 2003).

VII. The Rise of the Aerotropolis

Emerging corridors, clusters, and spines of airport-linked businesses are giving rise to a new urban form – the *aerotropolis* – stretching as much as 30 kilometers from gateway airports (Kasarda, 2000a,b,c). The airports function as the multimodal 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 1.5 for a generic illustration based on 12 major international airports). 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 56,000 people daily – more than the 50,000 resident criteria to attain metropolitan central city status in the U.S. Two major motorways 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, the rest of the Netherlands, and much of Western Europe.

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. Before going through customs, passengers walk through streetscapes of designer shops, boutiques, restaurants, authentic Dutch coffee corners, Internet cafes and even a gourmet supermarket. Another arcade of retail shops called See Fly Buy stores is in the area after immigration and security. This area also includes restaurants of all varieties, banks, business centers and even private rooms for a sauna, massage, or a few hours sleep. By combining terminal design with mall design, Schiphol has substantially increased revenues through 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. Two five-star hotels adjoin this complex. Within a 10-minute walk is another complex of high quality office buildings housing aviation-related business and internationally-oriented companies in financial and commercial services. The commercial value of this property is reflected in its office rents that command a solid premium in the Amsterdam area. Research by the international real estate firm Jones Lang LaSalle showed office rentals in the immediate airport area in 2000 were averaging 363 Euros (\$320) per square meter per year, compared to 250 in the Amsterdam city center and 226 in other Amsterdam suburban areas. Between 1997 and 2002, lease rates of prime space at Schiphol rose by 65 percent.

Providing further logistical advantage, the A4 and A9 high-speed motorways are within 500 and 1,000 meters respectively of the airport center. Radiating from Schiphol along these motorways are strings and clusters of regional headquarter office buildings and 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 1.6 illustrates the synergies between Schiphol 's Airport City and its broader *Aerotropolis*.

VIII. Aerotropolis Development and Planning Principles

Reflecting the new economy's demands for networking, speed and reliability, the *Aerotropolis* is optimized by corridor and cluster development, wide lanes, and fast movements. In other words, form follows function.

Although *aerotropoli* have so far evolved largely spontaneously – with previous nearby development often creating arterial bottlenecks – in the future they will be improved through strategic infrastructure planning. For example, (as illustrated in Exhibit 1.5), dedicated expressway links (*aerolanes*) and high-speed rail (*aerotrails*) will efficiently connect airports to nearby and more distant business and residential clusters. Special truck-only lanes should be added to airport expressways, as should be improved highway interchanges to reduce congestion. Seamlessly connected multimodal infrastructure will accelerate inter-modal transfers of goods and people, improving transport system effectiveness and further influencing nearby land values, business locations, and resulting urban form.

The metric for determining 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 speed to the airport from alternative 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 business location and commercial real estate organizing principles. Of course, accessibility and location are closely related.

Air commerce clusters and spines are already taking on distinct spatial form around major gateway airports such as Chicago O'Hare, Dallas-Ft. Worth, Miami, New York Kennedy, Washington-Dulles, Los Angeles, London Heathrow, Paris Charles de Gaulle and Amsterdam Schiphol. In the United States, even smaller, specialized air-cargo airports – such as Alliance Airport, near Ft. Worth, Texas, and Rickenbacker Airport, in Columbus, Ohio – are generating mini-*Aerotropoli* in the form of low density cluster and spine development. Alliance Airport alone has attracted over US\$4 billion in commercial real estate investments since 1994 to its 16,000-acre development area. I will return to these mid-size airports later in this chapter.

Those in the air cargo industry know that the competitive battle is won on the ground – not the air – with good highway connections key. This is why most of the world's leading air cargo airports also have excellent on-site or nearby truck cross-docking facilities. Many of the largest centers (e.g., Miami, LAX, Hong Kong, and Schiphol) are quadramodal, possessing efficient access to all four transportation modes (air, highway, rail, sea).

IX. Emerging Agile Logistics Hub/Aerotropolis Examples

Ontario, California

Commercial growth surrounding Southern California's Ontario Airport – an emerging agile logistics hub that cornerstones a major urban complex 40 miles east of Los Angeles – offers an excellent contemporary illustration of multimodal accessibility. The 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. Over 25 million square feet of warehouse and distribution space were added in 1999 and 2000 adjacent to the airport and along Interstates 10 and 15 radiating out from it. In 2001 and 2002, another 25 million square feet were added, led by e-commerce fulfillment and distribution facilities ranging up to 1 million square feet in floor space.

Enhancing Ontario's position as a leading logistics and e-commerce fulfillment center is the growth of air express transportation services at and around Ontario Airport. During 2002, UPS, whose west coast hub is at Ontario Airport, handled over 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, Emory Worldwide and Airborne Express. Ontario's development as a multimodal logistics hub has greatly contributed to making its surrounding "Inland Empire" the fastest growing major urban region in the United States.

Alliance, Texas

Another agile logistics hub example is Fort Worth (Texas) Alliance International Airport, where 15,000 acres (65 square miles) span two counties and includes 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, multimodality 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 Computers. Alliance provides a Foreign-Trade Zone, an enterprise zone, 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 multimodal 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 multimodality, 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.

Perhaps most important, all firm recruitment and development is managed by a private company, Hillwood Development. Of the US\$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 US\$150 million in property taxes generated.

Rickenbacher, Ohio

The third agile logistics hub example, centered at a mid-sized airport, is Rickenbacher International Airport in Columbus, Ohio. A former air force base, Rickenbacher was put into service in 1980 as an air cargo airport. Despite being a hub for the air cargo firm, Flying Tigers (now part of FedEx), Rickenbacher 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.

Rickenbacher’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 airport complexes that lacked multimodality and as efficient logistics operations. The airport, strategically located in the Midwest U.S. to serve national markets, has excellent access to major interstate highways and intermodal rail facilities. Like Shannon, International Airport Rickenbacher has an adjacent 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 US\$3 million per year from local governments. In addition, the State of Ohio has committed US\$65 million in revenue bonds for future facility improvements.

Economic development around Rickenbacker since 1991 has been remarkable. The airport serves as the logistics hub of a 15,000-acre (65 square mile) development zone nearly identical to Alliance, called the Rickenbacher 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 during 2001 and 2002, Rickenbacher experienced robust air cargo growth. Nearly 50 percent of Rickenbacher's cargo is international.

Rickenbacher 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. Rickenbacher's logistics and fulfillment firms are undergirded by state-of-the-art fiber optic loops, high-speed data circuits, and teleconference facilities.

As mentioned above, Rickenbacher'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, with thought leadership from Ohio State University's highly-regarded

Department of Logistics. Cost-benefit analyses have shown that for every U.S. dollar of public investment in Rickenbacher, three dollars in private investment have resulted with twenty-five dollars in regional economic impact, estimated to be US\$2.8 billion in 2002. This regional impact is forecast to grow to US\$3.8 billion in 2006.

North Carolina Global TransPark

The North Carolina Global TransPark (GTP) is a multimodal business center 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, 120 kilometers east of the Research Triangle Park and 70 kilometers from the Atlantic coast. At full build-out (forecasted to be around 2020), the project will have two long-range parallel runways, a state-of-the-art central cargo processing area, a highway-to-rail intermodal 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 available for private industrial, manufacturing and distribution facilities, all to be developed in a campus like environment.

Development History

In 1990, the author presented the conceptual outline for a new type of logistics infrastructure, a “Global TransPark” to North Carolina Governor James Martin and state officials.

A number of factors under-girded the concept:

- The rapid shift from national economies to global cooperative commerce;
- The emergence of just-in-time, flexible and agile manufacturing practices to reduce inventories for suppliers and customers and to provide quick customer response;
- The growing importance of air commerce which includes air cargo and air express;
- The need to utilize air commerce, shipment by sea and delivery by trucks and rail in an overall multimodal distribution system;
- The need for an advanced multimodal logistics hub in the Eastern United States to provide a gateway to global markets.

Studies at the University of North Carolina's Kenan Institute and the Department of Transportation prompted North Carolina government to seek legislative approval for the concept by establishing the North Carolina Air Cargo Airport Authority (later renamed, Global TransPark Authority) to conduct a feasibility study and produce a master plan for the project. A technical feasibility study was conducted by the state. The Federal Aviation Administration showed considerable interest in the concept from its inception, providing a \$1 million research grant to the Kenan Institute of Private Enterprise to research further the need for and configuration of an air cargo/industrial complex. The FAA also contributed \$300,000 to the state air cargo system plan/GTP technical feasibility study, and it provided \$622,000 towards the cost of the Global TransPark's Master Plan.

The Global TransPark Authority considered 11 site proposals from throughout North Carolina, before selecting an underutilized airport (the Kinston Regional Jet Port) in an economically lagging part of the state as the project site in May 1992. Political realities and the perceived need to stimulate

economic development in the state's most impoverished region drove this siting decision.

In 1993, the North Carolina Global TransPark Foundation, a private not-for-profit corporation, was established and began a \$30 million campaign for private money to assist development at the Global TransPark. In the same year, the 13-county regional Global TransPark Commission was chartered by the General Assembly to provide marketing, low-interest loans and grants for economic development in its member counties.

The Global TransPark Authority began its Master Plan for the Global TransPark in late 1992 and completed the plan in early 1994. The plan was prepared by a team of internationally recognized professionals, headed by Kimley-Horn and Associates Inc. of North Carolina, Bechtel Engineering of San Francisco, California, and Greiner of Dallas, Texas. Wilbur Smith Associates of South Carolina also contributed. The Master Plan depicted a Global TransPark of eventually 15,300 acres at full development with two parallel runways of 11,500 feet and 13,000 feet.

The Master Plan's original configuration called for a new runway in the first phase of the development. The Global TransPark Authority later modified the plan to extend the existing 7,600-foot runway to 11,500 feet in lieu of constructing an expensive all-new runway. A second runway remains a part of the Master Plan and will to be developed when needed. The Master Plan also identified the road and rail network to serve the Global TransPark and provide distribution links to deep-water ports. It included engineering, design, environmental, and forecast elements.

As part of the Master Plan, the Global TransPark Authority conducted an Environmental Assessment to measure impacts that would result from development of the Global TransPark. The assessment was accompanied by a Conservation Plan, which detailed a number of positive steps to be taken

regarding wetlands. An Environmental Assessment is a comprehensive study but is not as detailed as an Environmental Impact Statement (EIS). In May 1994, at the end of the review period for the Environmental Assessment, the FAA requested a full Environmental Impact Statement. The EIS was performed and the FAA concluded the EIS process with a Record of Decision issued in September 1997.

In August 1996, Mountain Air Cargo/Mountain Aircraft Services Inc. opened a new \$8.5-million maintenance hangar and office complex. Mountain Air Cargo, a major contract carrier for FedEx, maintains a fleet of 62 aircraft that serve 30 states, Canada and the Caribbean. A sister corporation, Mountain Aircraft Services, LLC, performs aircraft maintenance for Mountain Air Cargo and other companies.

Mountain Air Cargo's 65,000-square-foot facility was built by the Global TransPark Foundation and is being leased by the company. The Global TransPark Commission also leases office space in the Mountain Air Cargo facility. Mountain Air Cargo employs 300 people at the Global TransPark.

In May 1996, the Global TransPark was designated as a Foreign Trade Zone similar to Shannon's Free Zone. It allows companies within the Global TransPark to defer, reduce or eliminate payment of some tariffs and duties. It also provides incentives for companies to maintain production facilities in the United States. Companies that are not located within the perimeter of the Global TransPark are eligible to apply for subzone status, giving them the same trade advantages.

In early 1997, the Authority requested and received state and federal funding for a \$6.3 million training and education center for the Global TransPark. The center is now completed and operational. Through a cooperative arrangement with the 11 regional community colleges in the Global TransPark

Region, the center offers training programs for workers in a wide range of logistics and skilled blue-collar jobs.

Thus far, approximately \$80 million has been allocated from federal and state governments with an expected total investment of \$250 million required for full development.

Organization and Management of the GTP

Two GTP organizations are working together to achieve development at the Global TransPark site, while the third one is devoted to economic development in the 13-county Global TransPark Region. Their responsibilities differ, but their efforts complement each other. The three organizations are:

- The North Carolina Global TransPark Authority
- The Global TransPark Foundation
- The Global TransPark Development Commission

The North Carolina Global TransPark Authority is the state agency responsible for developing and operating the North Carolina Global TransPark. The Authority's activities have included:

- Conducting a technical feasibility study on the potential for a global industrial and distribution complex.
- Conducting a statewide site selection process.
- Selecting the site (Kinston Regional Jet Port).
- Negotiating and signing an agreement for the transfer of the Kinston Regional Jet Port (an asset valued at \$140 million) to the Authority.
- Developing the Master Plan for the Global TransPark.
- Conducting an Environmental Assessment of the Global TransPark complex.

- Sponsoring and participating in meetings to inform the public about the Global TransPark.
- Working closely with numerous federal agencies, including the Departments of Commerce, Transportation and Defense, to secure support for the Global TransPark.
- Introduction and marketing of the Global TransPark concept to companies nationally and internationally.
- Applying for and securing designation of the Global TransPark site as a Foreign Trade Zone.
- Entering into a cooperative agreement with the Subic Bay project in the Philippines, as well as the U-Tapao project in Thailand; negotiating with other countries for similar agreements as part of a global manufacturing/distribution network.
- Securing funding from the General Assembly and the U.S. Department of Commerce for on-site education and training center.
- Working with the Federal Aviation Administration to complete the Global TransPark's Environmental Impact Statement.
- Working with federal officials to secure funding for runway improvements.

The North Carolina General Assembly has given the Authority a broad range of powers, including land-use zoning up to six miles from the GTP periphery, eminent domain, and the ability to issue industrial development and revenue bonds. In coordination with the authority, a nonprofit private corporation, the Global TransPark Foundation, Inc., provided a range of services and financial resources for the project. Its board of directors is composed largely of business leaders throughout the state. In addition, a 13-county GTP Development Commission was formed to facilitate economic development

initiatives and environmental planning in the region surrounding the Global TransPark. A \$5 annual registered vehicle fee within these counties was approved for five years to provide additional infrastructure support resources. This fee is no longer active.

Challenges and Hurdles to GTP Progress

Only 700 people are currently employed at the GTP which is disappointing to many. Locational problems have created severe constraints. As noted, the North Carolina GTP Authority purposely selected a relatively isolated low income region of the state as the site of the GTP to spur job growth, income and overall economic development of the 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 about 40 miles from the nearest interstate quality, limited access highway and building high speed highway connectors to the interstate will take years. 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 2,400 meters 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 3,700 meters 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. Without federal environmental approvals (which is an involved and extensive process in the United States) 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 further discourage 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 and private sector development consultants. Shannon International Airport with its modern airport infrastructure in place and well-established nearby industrial bases faces neither of the critical problems which have delayed development of the North Carolina GTP. Shannon also possesses an in-place air cargo and passenger network that the NCGTP lacks.

Southern California Logistics Airport

Another effort to create an air logistics center that has faced similar difficulties is Southern California Logistics Airport (SCLA) in the high desert, nearly 100 miles northeast of Los Angeles. This converted former air base is considered too isolated for air express activity and its local industrial base is not strong. 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 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, Shannon International Airport is in a much better position with an established international aviation network and local industrial base. Shannon is also the dominate airport in the west of Ireland, though Cork (whose service area overlaps with Shannon will likely pose new competition once Aer Rianta is disbanded).

Asia Agile Logistics Hubs

Aerotropoli are also emerging in distinct patterns around agile logistics hubs in Asia. One example is Lantau Island, where the relatively new Hong Kong International Airport is spawning highly visible business and commercial

clusters directly linked to the airport. Ten million square feet of commercial land is being developed adjacent to the main passenger terminal. This area, known as Hong Kong Sky City, will contain office and retail, a business park, and a large hotel, leisure and entertainment complex. (See Exhibit 1.7) In addition, a US\$500 million international exhibition center for trade representative offices and trade shows is being developed.

The Walt Disney Company has announced that it will locate its third international theme park (Hong Kong Disneyland) on Lantau Island to take advantage of the international airport and its high-speed dedicated rail (*aerotrain*) and expressway (*aerolane*) links to Kowloon and Hong Kong. This siting decision is not unlike those Disney made earlier for Tokyo Disneyland, near Narita International Airport, and EuroDisney, near Paris's Charles de Gaulle Airport.

Hong Kong International Airport's regional impact includes southern China via high-speed ferries and cargo water shuttles, efficiently connecting 14 nearby coastal mainland manufacturing and commercial centers to the airport. Lantau's quadramodality (*aerolanes*, *aerotrain*, airplanes and sea/air links) will be integrated and enhanced through 21st-century-designed mixed-use passenger/commercial terminals, business centers, and logistics parks at or near the airport. Hong Kong International Airport's future growth will be made possible through plans to float an IPO as part of a privatization process. Hong Kong International will not become completely privatized, though, but operate as a public-private partnership.

A major planned logistics hub/*aerotropolis* is under development at Incheon, South Korea, where the government is creating a 24-hour "Winged City" on Yongjong Island, about 50 kilometers (35 miles) southwest of downtown Seoul. The new international airport (which opened in 2001) will anchor an expansive urban agglomeration composed of commercial, industrial, residential, and tourism sectors. One of its centerpiece will be Media Valley,

Korea's version of Silicon Valley. Designed as a center for global high-tech industries, Media Valley is being constructed adjacent to the airport on a 3.6-million-square-meter site that will include a large techno-park and a university research center. (Exhibit 1.8)

As of 2000, 625 companies – including 49 companies from Canada, Israel, Japan, The Netherlands, Taiwan, and the United States, among others – had submitted letters of intent to move into Media Valley. International consulting firm Arthur D. Little predicts that by 2005, a total of 2000 companies will be located in Media Valley's campus-like setting (Business Korea, 2000).

A new town is being developed to serve as a residential base for those employed at Media Valley and in other sectors of this emerging *aerotropolis*. Dedicated expressways and planned *aerotrails* will connect to downtown Seoul and give both Media Valley employees and the new town residents high-speed access to Incheon Airport.

By 2005, the airport will be complemented by a seaport and a teleport now under construction. The plan is to form a consolidated agile logistics "triport" for 21st century transportation, distribution, and information processing.

In November 2003, Korea's Ministry of Construction and Transportation released a development blueprint to make Incheon the primary transportation hub of northeast Asia. Key to development is automating all customs services to boost cargo traffic (including paperless electronic processing of all shipments valued below U\$2,000) and the development of various commercial facilities. Along with 900,000 sq. m. tariff free zone, a 3.1 sq. km. international business zone will be developed containing offices and hotels. Another new commercial city (5.5 sq. km.) is planned in the Songdo area of Incheon which will include a 60-story convention and trade center, 60 office buildings, four deluxe hotels and a golf course, all to be built between 2004 and 2010. at the core of the development will be a canal and public square modeled on St. Marks Square in

Venice. The design is structured to combine the best aspects of Hong Kong, Paris, and Venice.

Another ambitious *aerotropolis* is being planned around the Kuala Lumpur International Airport in Malaysia. This massive new airport is designed to provide the aviation foundation for Malaysia's Multimedia Super Corridor (MSC), a high-tech government, commercial, education, and residential zone about the size of the city of Chicago. Promoted internationally as the future information and communications technology center of Asia, MSC will contain two new cities (Putrajaya, the relocated government capital, and Cyberjaya, or Cyber-city, each of which will house about a quarter of a million residents), along with a multimedia university to train IT workers. MSC's hard infrastructure is being complemented by a soft infrastructure of laws and policies with the objective of creating a unique commercial environment for developing and merging 21st century audio, video, and data transmission technologies.

Perhaps the most efficient agile logistics hub that is evolving into a full *aerotropolis* is Singapore's Changi International Airport. At its landside core, the passenger terminals house arcades designed around thematic retail, restaurant, and entertainment center concepts. Open 24-hours a day, Changi's arcades also include lounges, business centers, transit hotels, fitness centers, saunas and local area networks (LANs) providing computer-equipped passengers with free wireless access to the Internet.

Changi's wide, uncongested *aerolane* to downtown Singapore is being complemented by an *aerotrain* going directly from the city center to the terminals. An air logistics park adjacent to the airport is designed to further improve Singapore's rapid fulfillment functions and allow third-party logistics providers (3PLs) to offer distant customers highly customized products at minimum response time. Virtually every major 3PL in the world is active in and around Changi.

X. European Competitors

These are some potential competitors to the proposed Shannon ALH. These include Vatry International Airport in the Champagne region of France, about 130 kilometers 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 tonnes 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 120 kilometers from Frankfurt, is likewise positioning itself as a multimodal air cargo complex. This former U.S. airbase has consistently raised its freight tonnage from just 5,500 tonnes in 1997 to over 130,000 tonnes in 2002, the vast majority truck freight, however. Frankfurt AG 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 an integrated express land as well as complete logistics services including all documentation and processing of special cargo. The airport features 24/7 operation and is the German base of a number air cargo charter companies, including the Western European hub of Volga-Dnepr Heavy Lift. It also serves as the European hub for Antonov (Russia) and as the German base for low-cost Passenger carrier Ryanair. Although growth of real air freight has been sluggish at Hahn, it continues to work with Lufthansa and Fraport to get a major potential

boost if and when a total night flight ban becomes operational at Frankfurt-Main which was negotiated as part of its agreement to add a fourth runway in 2006.

A relatively unknown, but apparently up and coming, cargo airport in England is Manston Airport about 90 kilometers from London. Manston was originally Kent International Airport until it was acquired in 1999 by the Wiggins Group, Plc from the British Ministry of Defense who then changed the name of this former RAF base to Manston Airport. The Wiggins Group proceeded to invest 12 million British pounds in the 700- acre facility and began advertising it as London Manston. They have had some success with cargo throughput increasing from 5,000 tonnes in 1999 to 40,000 tonnes in 2002. An Arthur D. Little study forecasts cargo to reach 200,000 tonnes in 2005. Passenger traffic is currently at 16,000 annually. One company that chose to switch its UK operations from Stansted to Manston is MK Airlines, a Ghanaian air cargo company flying two 747s and eight DC-8s. According to a company executive quoted in *Air Transport Week* (May 2002), "speed and efficiency were the main drivers behind the move – our offload from landing to the trucks leaving the airport site improved from 3-4 hours to 40-60 minutes." Manston is promoting its speed advantage over London's large airports in an effort to attract businesses.

Shannon International Airport will continue to face its greatest competitive challenge from Europe's major airports: Frankfurt, Paris DCG, Heathrow and Schiphol. Yet, the growing importance of smaller air cargo and logistics complexes is testified to by the fact that these major airports have been taking equity stakes or management positions in such airports as their cargo prospects grow. There is some feeling that the smaller air cargo airports will get a boost in the future not only by bans on night flying at Western Europe's largest airports, but also cargo security issues. The latter poses a significant opportunity

for Shannon International Airport if it can implement a fast, flexible and reliable air cargo security clearance system that is unmatched in Europe.

XI. Shannon's Agile Logistics Hub and Aerotropolis Potential—Credibility and Viability, and Transferability of the U.S./Asia Experience

Of course, Shannon does not have the commercial scale nor the international airport connectivity of a Dallas-Ft. Worth, Chicago, Miami, in the U.S. or a Hong Kong, Singapore, or Incheon in Asia. Yet it is comparable to a Memphis, Louisville, and Ontario California, absent the air express services that they possess, and perhaps better positioned air service-wise than an Alliance or Rickenbacher Airport for international connectivity. It is certainly better positioned than Vatry, Hahn or Manston in Europe and the Global TransPark and Southern California Logistics Airport in the U.S. Shannon Free Zone is recognized as not only the first, but among the most successful free zones in the world.

The Shannon region has attracted dozens of international high-tech firms during the past decade that are export-oriented, as well as advanced service sector firms. The region is strategically located in the American-European air transport corridor. It has moderate costs compared to the U.S. and Western Europe, a well-educated, English-speaking labor force, a world-class university (Limerick), and an excellent network of technology and business parks. While it is lacking the multimodality and efficient surface transportation links of an Alliance or Rickenbacher or an air express hub, these are challenges that can be addressed. Recall, neither Alliance nor Rickenbacher had much to show in the early 1990s at which time they developed and leveraged their multimodality and inland port status with an effective logistics management and marketing strategy to “take-off.” Alliance and Ontario, CA, received their big boost when FedEx and UPS, respectively, established their regional air express hubs there providing

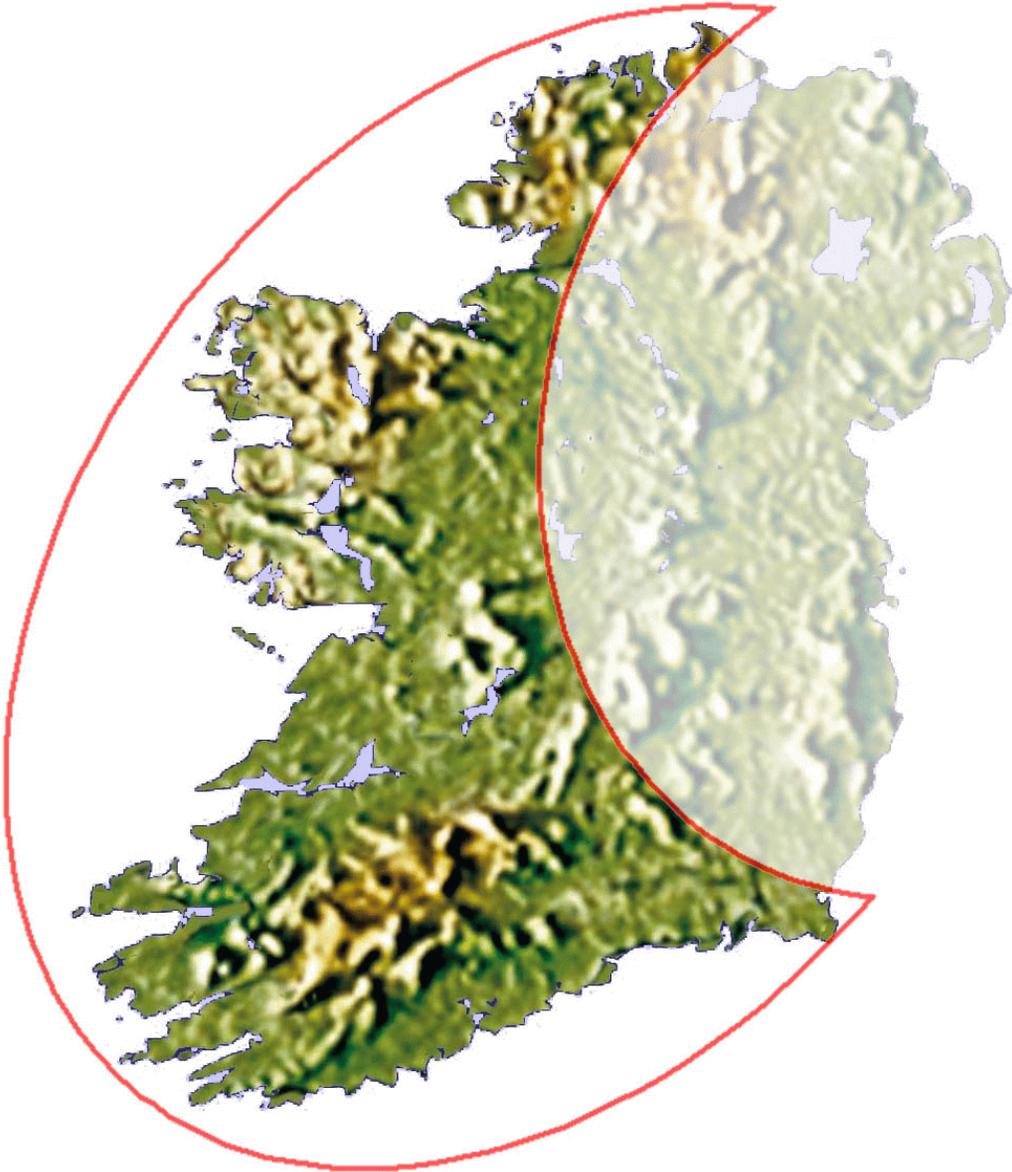
the “speed” advantage to other multimodal and telecommunications assets they leveraged.

Given its baseline assets noted above, Shannon has a credible and viable opportunity to put in place an agile logistics hub and manage and market it effectively to achieve similar commercial success and regional economic leveraging in the decade ahead. As this occurs, it is highly likely that many of the *aerotropolis* features one sees emerging around and outward from U.S. and Asian air logistics hubs will take place in the Shannon region. Its economic impact will be felt throughout the greater Atlantic Arc region and, indeed, all of Ireland, boosting the competitiveness of the entire nation.

The following chapter describes what needs to be done in terms of logistics infrastructure, planning at and around Shannon International Airport and throughout the greater Atlantic Arc region to generate similar local and regional economic development successes that have occurred in the U.S. and Asia. Chapter 3 will then propose the business plan guidelines, functional requisites, critical success factors and marketing principles to create a complementary and reinforcing commercial environment. This chapter will also describe some first-order estimates of costs and revenues of an agile logistics hub based on Global TransPark financial assessments in the U.S. and Thailand.

The final chapter will offer implementation plan guidelines for a Shannon agile logistics hub and regional logistics network, including timetables for infrastructure development phasing, key actors who must be brought to the table and suggested management options for development and operation of a Shannon agile logistics hub and greater Atlantic Arc network.

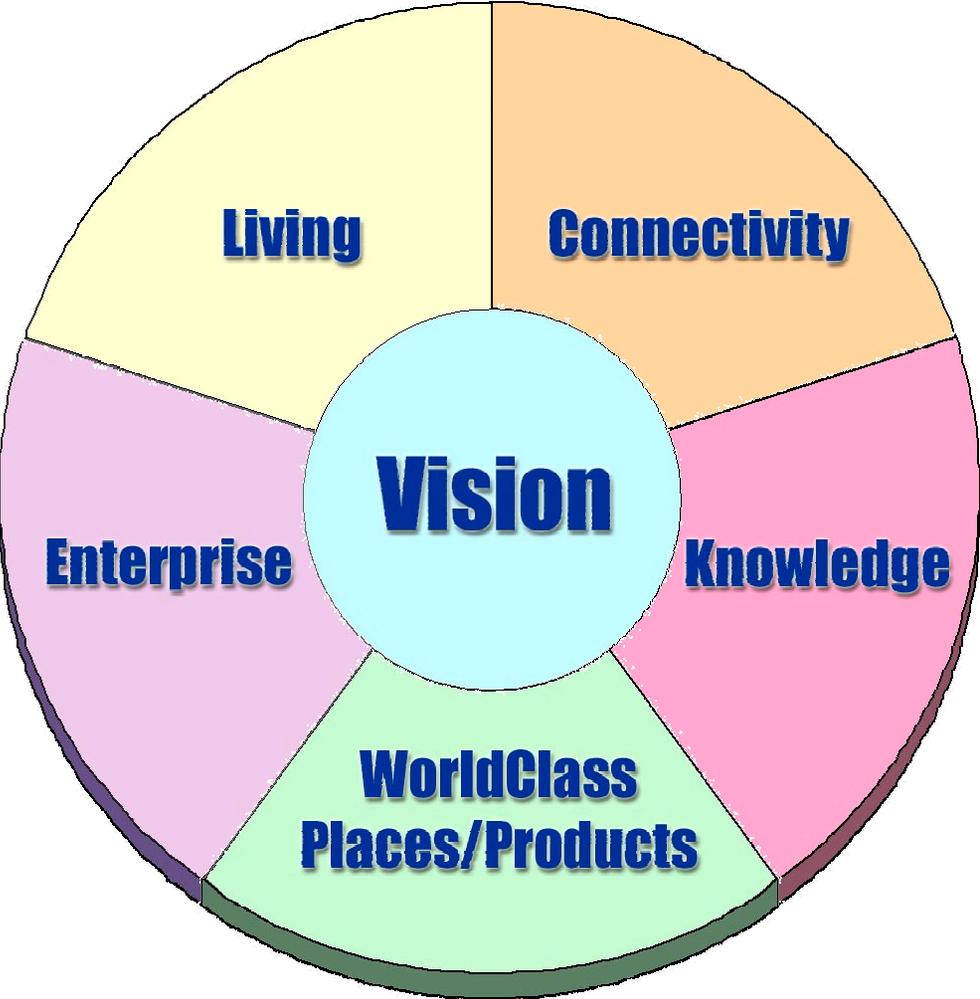
EXHIBIT 1.1
IRELAND'S ATLANTIC ARC REGION



Source: Shannon Development.

EXHIBIT 1.2

DEVELOPMENT DEVELOPMENT STRATEGIC FRAMEWORK AND INITIATIVES



Source: Powerpoint presentation by Kevin Thompstone, 4 September 2003, Shannon Development.

EXHIBIT 1.3
DESTINATIONS SERVED BY
DIRECT SCHEDULED SERVICES



EXHIBIT 1.4

IRELAND MERCHANDISE TRADE TO/FROM THE UNITED STATES: 1990–2002

| | | EXPORTS | | | | | | | |
|--------------|--------|---------------|---------------|----------------|----------------|----------------|----------------|----------------|--|
| | Year | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | |
| VALUE (USD) | Total | 4,388,441,824 | 5,527,064,387 | 8,011,437,130 | 10,656,284,604 | 15,909,789,074 | 18,077,500,699 | 21,883,191,851 | |
| | Air | 3,644,156,660 | 4,776,816,399 | 7,233,747,704 | 9,748,131,360 | 14,914,723,610 | 16,815,392,152 | 20,359,962,439 | |
| | Vessel | 744,285,164 | 750,247,988 | 777,689,426 | 908,153,244 | 995,065,464 | 1,262,108,547 | 1,523,229,412 | |
| Weight (kgs) | Total | 244,046,408 | 388,884,366 | 390,146,486 | 576,234,192 | 741,041,341 | 465,509,364 | 547,454,854 | |
| | Air | 18,947,905 | 21,389,361 | 24,578,647 | 27,018,831 | 31,105,393 | 30,537,668 | 36,331,017 | |
| | Vessel | 225,098,503 | 367,495,005 | 365,567,839 | 549,215,361 | 709,935,948 | 434,971,696 | 511,123,837 | |
| | | IMPORTS | | | | | | | |
| | Year | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | |
| VALUE (USD) | Total | 3,315,434,769 | 4,227,324,071 | 5,152,133,596 | 5,559,372,041 | 6,821,019,833 | 6,237,506,018 | 5,771,318,314 | |
| | Air | 2,616,613,946 | 3,393,817,077 | 4,213,656,597 | 4,605,266,468 | 5,789,716,526 | 5,162,648,669 | 4,707,135,047 | |
| | Vessel | 698,820,823 | 833,506,994 | 938,476,999 | 954,105,573 | 1,031,303,307 | 1,074,857,349 | 1,064,183,267 | |
| Weight (kgs) | Total | 1,965,946,069 | 1,807,488,775 | 2,586,995,594 | 2,457,515,395 | 2,052,976,264 | 1,896,329,268 | 2,335,457,300 | |
| | Air | 26,358,760 | 32,675,498 | 36,934,605 | 41,066,973 | 45,867,781 | 40,484,395 | 36,410,567 | |
| | Vessel | 1,939,587,309 | 1,774,813,277 | 2,550,060,989 | 2,416,448,422 | 2,007,108,483 | 1,855,844,873 | 2,299,046,733 | |
| | | TOTAL | | | | | | | |
| | Year | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | |
| VALUE (USD) | Total | 7,703,876,593 | 9,754,388,458 | 13,163,570,726 | 16,215,656,645 | 22,730,808,907 | 24,315,006,717 | 27,654,510,165 | |
| | Air | 6,260,770,606 | 8,170,633,476 | 11,447,404,301 | 14,353,397,828 | 20,704,440,136 | 21,978,040,821 | 25,067,097,486 | |
| | Vessel | 1,443,105,987 | 1,583,754,982 | 1,716,166,425 | 1,862,258,817 | 2,026,368,771 | 2,336,965,896 | 2,587,412,679 | |
| Weight (kgs) | Total | 2,209,992,477 | 2,196,373,141 | 2,977,142,080 | 3,033,749,587 | 2,794,017,605 | 2,361,838,632 | 2,882,912,154 | |
| | Air | 45,306,665 | 54,064,859 | 61,513,252 | 68,085,804 | 76,973,174 | 71,022,063 | 72,741,584 | |
| | Vessel | 2,164,685,812 | 2,142,308,282 | 2,915,628,828 | 2,965,663,783 | 2,717,044,431 | 2,290,816,569 | 2,810,170,570 | |
| | | EXPORTS | | | | | | | |
| | Year | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | | |
| VALUE (USD) | Total | 1,567,851,441 | 1,793,853,390 | 2,002,330,325 | 2,306,170,883 | 2,258,359,901 | 3,743,495,408 | | |
| | Air | 1,045,110,048 | 1,245,140,918 | 1,421,745,496 | 1,715,585,441 | 1,649,336,756 | 2,979,277,524 | | |
| | Vessel | 522,741,393 | 548,712,472 | 580,584,829 | 590,585,442 | 609,023,145 | 764,217,884 | | |
| Weight (kgs) | Total | 276,838,757 | 185,387,729 | 196,882,113 | 173,134,178 | 257,405,779 | 251,020,733 | | |
| | Air | 9,050,264 | 8,849,468 | 10,677,213 | 12,049,008 | 14,556,548 | 14,953,699 | | |
| | Vessel | 267,788,493 | 176,538,261 | 186,204,900 | 161,085,170 | 242,849,231 | 236,067,034 | | |
| | | IMPORTS | | | | | | | |
| | Year | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | | |
| VALUE (USD) | Total | 2,214,726,888 | 2,286,940,847 | 2,317,362,491 | 2,502,925,207 | 3,178,689,888 | 3,752,902,142 | | |
| | Air | 1,649,390,053 | 1,622,577,127 | 1,696,609,863 | 1,899,972,012 | 2,524,573,951 | 2,973,240,023 | | |
| | Vessel | 565,336,835 | 664,363,720 | 620,752,628 | 602,953,195 | 654,115,937 | 779,662,119 | | |
| Weight (kgs) | Total | 2,106,535,719 | 2,558,749,270 | 2,604,549,830 | 2,271,060,485 | 2,521,885,005 | 2,509,595,770 | | |
| | Air | 13,866,259 | 16,078,311 | 16,677,326 | 20,795,179 | 23,576,855 | 25,621,125 | | |
| | Vessel | 2,092,669,460 | 2,542,670,959 | 2,587,872,504 | 2,250,265,306 | 2,498,308,150 | 2,483,974,645 | | |
| | | TOTAL | | | | | | | |
| | Year | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | | |
| VALUE (USD) | Total | 3,782,578,329 | 4,080,794,237 | 4,319,692,816 | 4,809,096,090 | 5,437,049,789 | 7,496,397,550 | | |
| | Air | 2,694,500,101 | 2,867,718,045 | 3,118,355,359 | 3,615,557,453 | 4,173,910,707 | 5,952,517,547 | | |
| | Vessel | 1,088,078,228 | 1,213,076,192 | 1,201,337,457 | 1,193,538,637 | 1,263,139,082 | 1,543,880,003 | | |

Source: U.S. Department of Commerce, Merchandise Trade machine-readable files, 2003.

EXHIBIT 1.5
AEROTROPOLIS SCHEMATIC

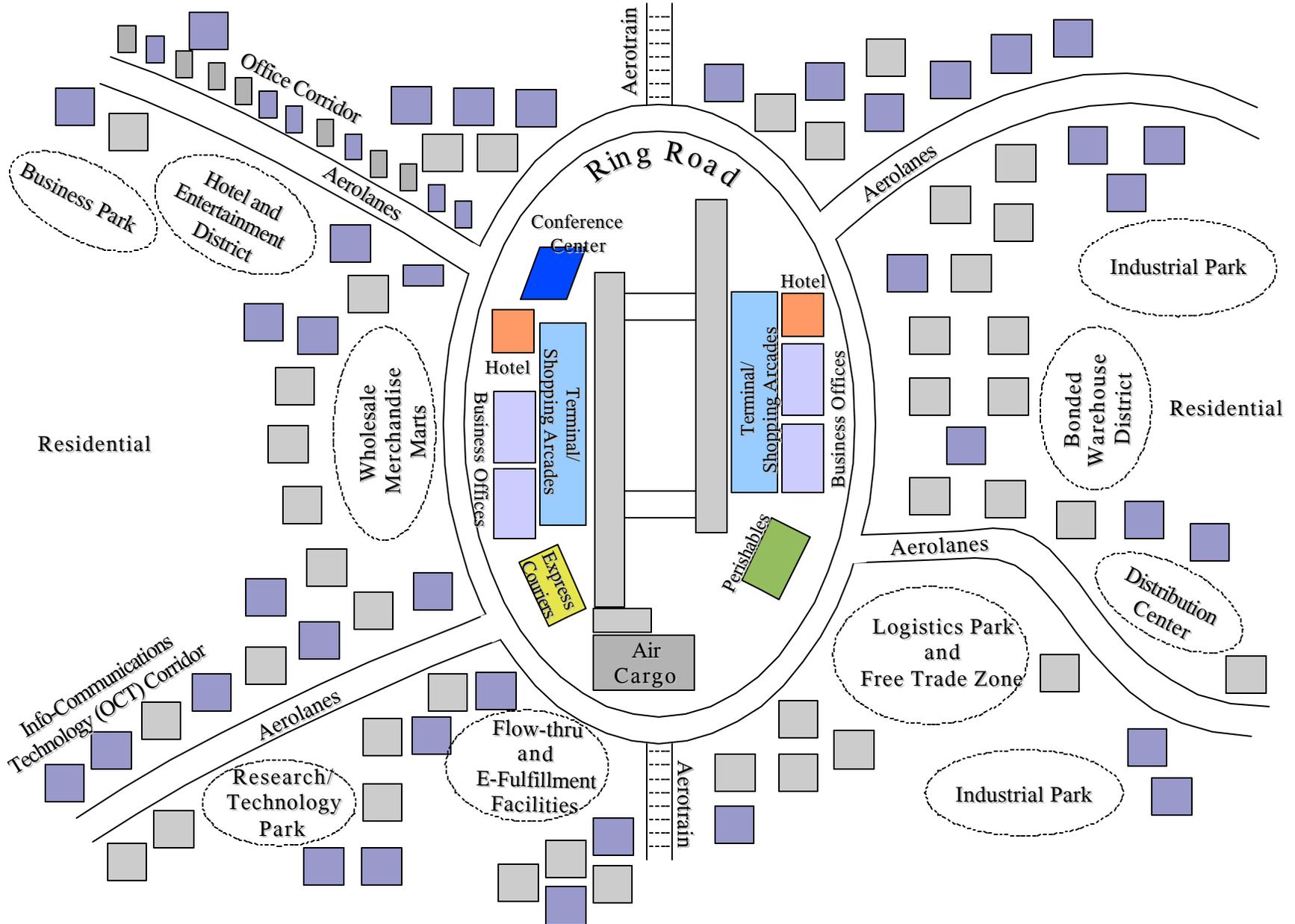


EXHIBIT 1.6
 AMSTERDAM-SCHIPHOL AIRPORT CITY–AEROTROPOLIS SYNERGIES

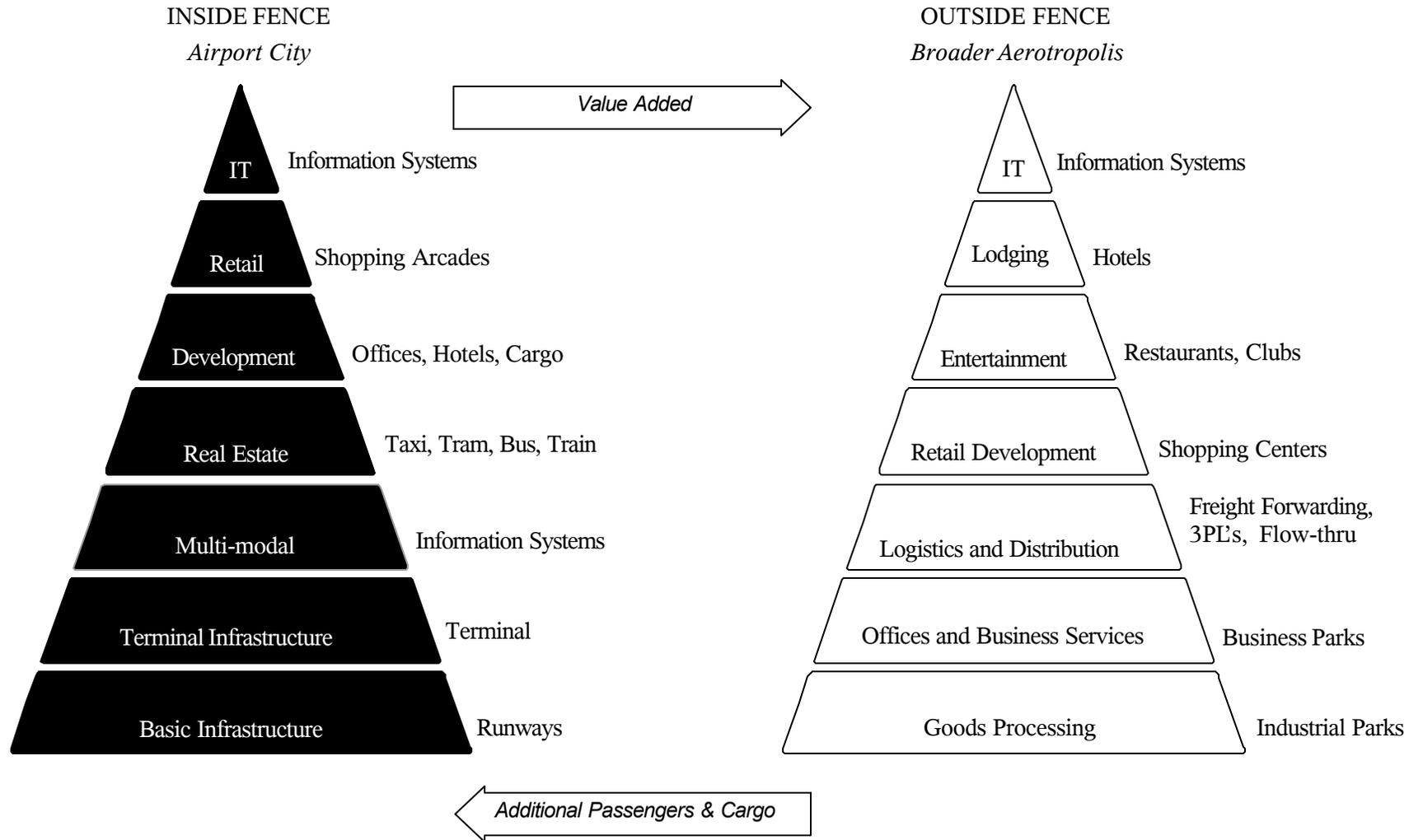


EXHIBIT 1.7
HONG KONG SKYCITY MASTER PLAN

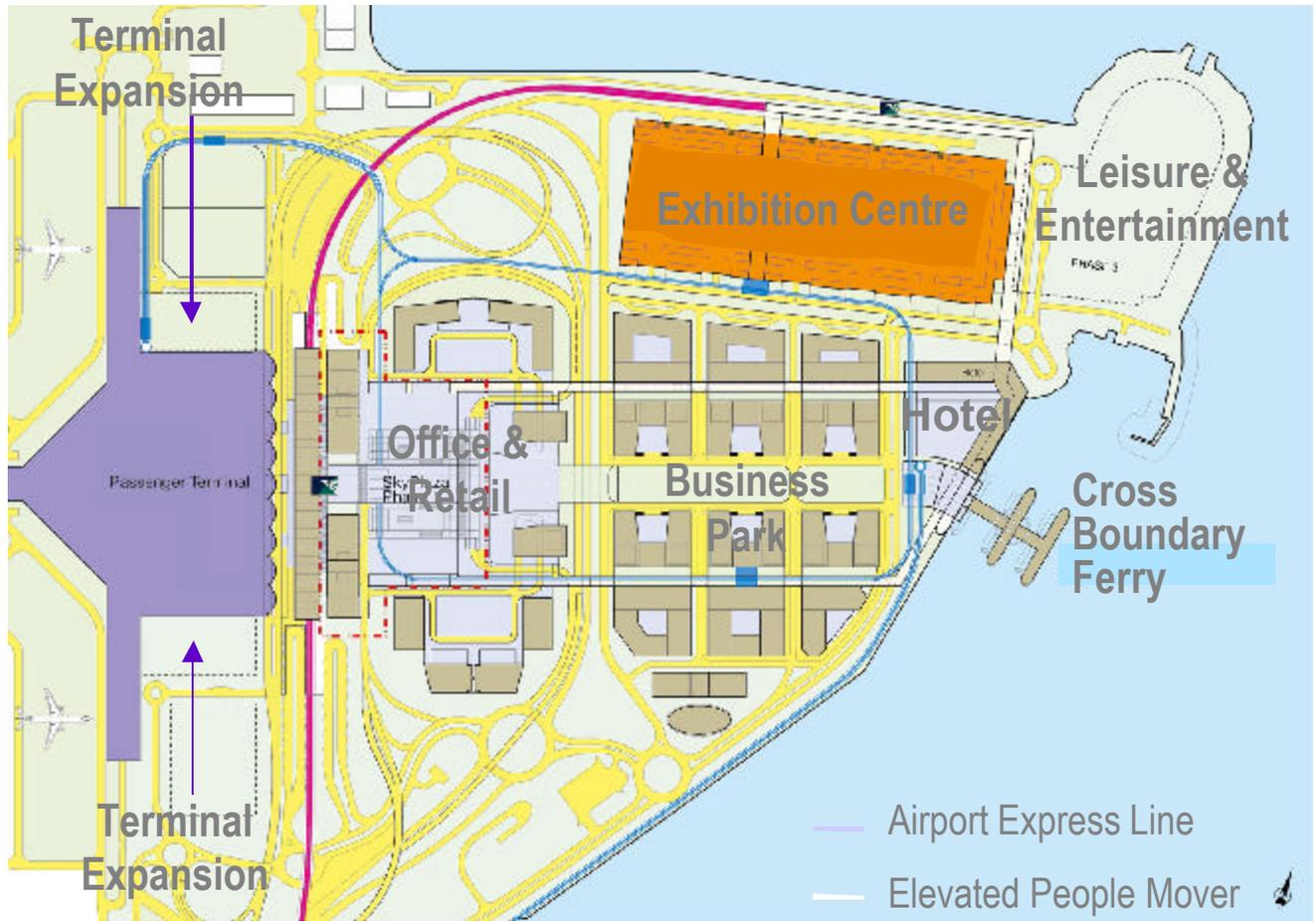


EXHIBIT 1.8
INCHEON INTERNATIONAL AIRPORT (SEOUL, KOREA)



Chapter 2

Shannon Agile Logistics Hub Infrastructure and Facilities Guidelines

I. Introduction

We turn now to basic infrastructure design guidelines and facilities for an agile logistics hub (ALH) centered at Shannon International Airport. Operating as a fully-integrated multimodal transportation and commercial complex, the ALH will enable tenants and firms throughout the Atlantic Arc region to respond flexibly and rapidly to their domestic and global suppliers and customers. Its logistical infrastructure and business support services should be designed to enhance the speed and agility of manufacturing, distribution and other time-sensitive industries having access to Shannon International Airport, thereby improving their competitiveness and catalyzing economic growth throughout the Atlantic Arc region.

In achieving this objective, logistics and commercial synergies and multimodal transportation upgrades should be developed throughout the region based on a solid working partnership leveraging the comparative advantages of each others' business assets, location, and infrastructure. Upgraded regional highways and new or extended rail lines bringing together Western Ireland ports, Shannon International Airport, and cities across the Atlantic Arc will catalyze regional economic complementarities and be a major impetus for achieving full regional development potential. These linkages and synergies will be elaborated in the next two chapters. Our focus in the present chapter is to provide design guidelines for critical agile logistics hub infrastructure and facilities at Shannon that will be the integrating commercial nexus and driver of the greater Atlantic Arc logistics network.

II. Basic ALH Infrastructure Design and Configuration

The ALH at Shannon will include many proven elements of a modern industrial park. What will set it apart is the fusion of modern manufacturing and distribution facilities with multimodal transportation, advanced telecommunications, efficient materials-handling systems, and commercial support services. Bringing these elements together according to ALH design principles will substantially improve access and response time of tenants and regional businesses to both domestic and international suppliers and markets. Exhibit 2.1 provides an overview of current configuration and highway linkages at and around Shannon International Airport. A number of key elements such as a long-range runway, cargo and passenger terminals, aircraft maintenance and Shannon Free Zone East and West are already in place.

Exhibit 2.2 describes the basic physical core design for an ALH at Shannon 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 multimodal (highway and rail) linkages to a seaport are a critical elements of the ALH and regional network.

Within the core area, a cargo transfer system (CTS) will carry materials, components, and finished products throughout the ALH 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 connects 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 handles primarily bulk products and containerized cargo and will be a valuable connection to port facilities and a regional network through new connecting rail lines in the greater Atlantic Arc

region. The IRF should also be linked to a new inland port with appropriate truck cross-docking facilities.

Key to the efficiency of the entire operating infrastructure are the ALH'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 ALH.

The hub of the central cargo area and cargo transfer system is the central cargo facility (CCF) located along one of Shannon's main taxiways (possibly to be developed). 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 Shannon ALH 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 2.3 ALH 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 ALH to local and regional highway systems and to the intermodal rail facility. Internal roads will connect the central cargo area and the tenants to the ring road.

The Shannon ALH must be conceived as more than a multimodal logistical infrastructure. Its full potential and ultimate success 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 multimodal transportation and cargo-handling systems, the ALH 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 Shannon ALH 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 Shannon ALH's tenants and regional users real-time access to worldwide supplier, distributor, and customer databases.

Expedited customs procedures using automated manifest systems and express customs clearance are also essential to facilitate tenant and user import and export activities. In addition, Shannon should expand its successful Free Zone West to other areas around and near the airport (such as Free Zone East) to allow tenants to defer, reduce, or eliminate payment of taxes and duties normally associated with importing and exporting parts, components and other goods, as well as to eliminate bureaucratic delays.

In focus group interviews conducted with potential industrial tenants for Global TransPark facilities in the U.S. and Thailand, 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 Shannon to market and distinguish itself among other competing industrial sites in Ireland and elsewhere in Western Europe.

III. Central Cargo Area Design

The basic design element of the ALH 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, a possible general aviation passenger terminal, nearby intermodal truck and rail terminals (linked to port facilities), special materials handling and freight forwarder and 3PL facilities, along with a Cargo Transport System (CTS) linking ALH tenants with cargo processing facilities. Since the CCA is the primary and most important component of the ALH, its development and design guidelines are elaborated below.

III-1. Guidelines for Central Cargo Area Design

Three key principles of agility should be followed in the design for the 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: 1) unpredictable longer-term cargo handling demands; and 2) 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 ALH tenants and users. A flexible, incremental development approach is highly recommended, given the difficulties of forecasting the exact types and levels of cargo activity at Shannon's ALH. 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 ALH. 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.

Three realities caution against initial automation of CCA materials handling and processing systems: 1) Shannon's airport operating area (AOA) will likely continue to have to accommodate all manner of aircraft and cargo equipment (i.e., standardization of aircraft gauge and related cargo handling equipment for serving an international air cargo market is currently not possible); 2) non-automated materials handling and accumulation (short-term storage) systems are often more cost-effective and flexible in terms of meeting peak requirements and other unanticipated immediate problems by simply providing more forklifts and manpower to meet unexpected or peak requirements; and 3) longer-term air cargo demand and other transportation mode cargo demand are difficult to forecast in early stages for a newly evolving complex such as the Shannon ALH. Only as actual demands are experienced over time for such a multimodal logistics complex would it be possible to incrementally predict materials handling, equipment, infrastructure, and facility needs, and to gain verification of the estimated industry mix of cargo demands placed on the Shannon ALH (e.g., parts and components, manufactured products, fresh cut flowers, seafood and other perishables, retail distribution products, etc.). For these reasons, it is recommended that the Shannon's ALH commence operations with relatively inexpensive, low-tech systems, to be upgraded over time as the demand and future tenant requirements become better known and the benefits to be acquired through automation become better understood, measured and demonstrated. One means of attaining processing flexibility, and commonly employed in modern just-in-time (JIT) operations, is to create subsystems that have multiple processing equipment rather than one large

processing system. Designing one large system often appears to offer economies of scale (i.e., less cost per unit produced as process equipment size increases). Such "all the eggs in one basket" type of operation, however, typically leads to inflexibility and an inability to shut down part of the total process capability for maintenance, equipment testing, equipment enhancing and even off-line employee training.

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 the Shannon's ALH.

Targeted Mechanization

Experiences of air cargo operations and associated materials handling needs at Shannon and airports elsewhere do permit initial determination of some targeted modest mechanization in Shannon's ALH 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.

As stressed above, because of the difficulty of predicting material handling demands for this first-of-its-kind facility in Ireland, and a desire to provide flexibility of arrangement which is consistent with 21st century business practices, the ALH facility design should assume that initial material handling operations would be performed with low-tech material handling equipment

(e.g., forklifts, motorized tugs, pallet jacks, etc.). This technology is not only far less costly but also "tried and true" time-tested and reliable. At likely relatively low initial levels of manufacturing and supply-chain management demand at the Shannon ALH, fully automated materials handling systems, though flashy, simply do not make economic sense

When demands over time become better known and experienced, one-at-a-time evaluation of potential productivity benefits of automated equipment and facilities can be assessed and enhancements implemented to take advantage of operational improvements. For example, as available Central Cargo Facility (CCF) space fills up over time with increased activity, pallet racks should be provided to gain better use of the facility cube. Later when sufficient put-away and picking requirements develop, fork-lift use would be discontinued for automated put-away and picking of cargo from racks and replaced by computerized rail-guided picking and put away equipment.

Expandability/Phased Growth

I have been stressing that demands placed on Shannon ALH facilities and their resulting space needs are difficult to predict with any confidence. This is why it was proposed that facility development at the Shannon ALH encompass flexible, evolutionary and phased growth. Facility requirements should be estimated as accurately as initially possible based on air cargo data currently available, but the Shannon ALH 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 ALH development to be modified as demand, resources, new technologies, and infrastructure advances occur. For example, the central cargo area should employ a modular layout for maximum

flexibility and phased development. Ground transportation designs should incorporate redundant routings and flexible road systems to minimize the impact of congestion or accidents, both within the ALH and in connecting highway systems. Rights-of-way should be sized to allow future expansion without negatively affecting ongoing highway operations. Shannon's runways must always be equipped with state-of-the-art navigational aids to allow for growing air capacity demands and eliminate weather delays. Extensive zoning controls in flight paths should be implemented to minimize potentially conflicting land uses and noise problems that could impede the required 7-day, 24-hour airport operation.

Public sector agencies responsible for Shannon Airport and the Shannon region also must be prepared to respond rapidly and creatively to evolving tenant and user needs and an ever-changing business environment; hence, Shannon ALH management itself must be agile as it creates or coordinates "one-stop shop" support for tenants and regional users from each logistical or institutional sector. In this sense, such agencies may not only wish to market the ALH, but is also will operate as a strategic partner with tenants and users in dealing with Customs and other Irish government agencies and in seeking access to a full range of technical, financial, and political resources. It is my understanding that Shannon Development already does a good deal of this.

Consistent with ISO 14000 standards (international standards that enable companies to systematize and improve their environmental management efforts), maintaining environmental quality and safety are a fundamental objective of ALH planning and development. The ALH system must provide facilities and procedures for the handling, storage, transportation, and disposal of environmentally sensitive materials as a continuous process. Likewise, modern ALH utility systems must offer high-quality and reliable power, water,

natural gas, wastewater treatment, and solid-waste disposal to meet growing tenant needs.

Each potential tenant should be evaluated for its compatibility with environmental regulations and standards. The Shannon 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 in the original Free Zone West should be restored or replaced, making the ALH more appealing to potential tenants where feasible. Ideally, the Shannon ALH should appear more like a university campus than a traditional industrial/logistics park.

Although cost savings remain important in today's industrial location decisions, the ALH system should be designed and developed on the assumption that tenants will pay more for its integrated, high-quality, reliable services and sound environmental planning. Because a delicate tradeoff exists between costs and on-site services, however, the ALH'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 reserving spacious rights-of-way 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 Shannon logistics hub.

One 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 Shannon ALH 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 ALH, 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), and relevant information, including appropriate signage and parking are needed, to serve the international cargo handling needs of ALH's tenants and region-wide users.

III-2. Major Facilities within the CCA

The Central Cargo Area, as noted, is the primary area within the ALH for processing of shipments. These include just-in-time (JIT) fabricators, assemblers, and distributors, and their 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. Major facilities located within the CCA should include the following:

- Central Cargo Facility (CCF)
- Customs Clearance Center (CCC)
- Perishables Center (PC)
- Decompression Facility
- Fumigation Facility
- Live Animal Inspection
- Live Animal Holding/Quarantine Area
- Ground Support Equipment (GSE) Staging (Parking) Areas
- GSE Maintenance and Service Facility
- All-Cargo Aircraft Parking Apron
- Aircraft Maintenance
- Truck Loading/Unloading Court
- Freight Forwarder and 3PL Facilities zone
- Visitor/Customer/Employee Parking

III-3. Central Cargo Area Activity Relationships

An activity relationship chart for the CCA should be developed to assure the efficient and continuous flow of various types of cargo through the ALH. Proximity relationships for space within the CCA building, and between other associated buildings, should be determined as a guide to facility layout. Specific activity and space relationships clarified through the CCA relationship analysis - both within the CCA and from/to other facilities - should be determined for the following elements of the CCA, as appropriate:

- CTS - The Cargo Transportation System's most desirable interface points between the Central Cargo Facility and the CTS land network are at the receiving dock where goods arrive on the CTS for processing as outbound shipments and the delivery dock where processed inbound cargo is ready for transport by the CTS to Shannon ALH tenants. The CTS should run the full length of the CCF building (initial and ultimate buildout) and other ALH manufacturing and distribution facilities. It is recommended that the CTS be above grade, reached by ramps within the CCF, and other hub facilities in order to eliminate problems of cross flow of cargo on the main floor of the CCF or on-site manufacturers, distributors and 3PLs.
- Security X-Ray and Decompression Facilities - Security X-ray equipment and decompression facilities are closely related to outbound cargo. As such, they need to be close to outbound and transit air cargo accumulation areas. The decompression facility, however, poses a hazard to neighboring personnel, facilities, and equipment. Because of those hazards, the decompression facility should be located in an area where there is the least likelihood of major interaction with large numbers of personnel or major facilities. The

area surrounding the decompression chamber should be cleared of personnel or major equipment assets during its occasional operation.

- EDI - The services provided by the electronic data interchange (EDI) system will be required wherever cargo is processed including receiving, inspection, make up, breakdown, accumulation, and delivery. The capability for input and readout of data must therefore be available at all points where cargo is processed.
- Fumigation Area - Given anticipated growing flows of agricultural products through the ALH, fumigation of products will likely be required predicated on country of destination or, in cases of in-bound flows, origin. Fumigation can take place on an open apron type area (under tent type covers) and should be remote from other functions to prevent hazards to personnel or contamination of other cargo by fumigation chemicals.
- Hazardous Materials - Hazardous materials should be processed in an isolated or protected area. If processed within the Central Cargo facility building, it is recommended that an area be set aside and isolated by fire walls and doors. Radioactive materials may require a special vault.
- Live Animal Quarantine - The quarantine of live animals within the CCA is not recommended because of aircraft noise and air pollutants. A more remote location at the ALH or an off-site location is recommended for live animal quarantine.
- Perishables Center - Some perishable goods may be processed within the CCF. As the volume of such goods increases, however, separate perishables centers would be added. Some refrigerated and freezer space should always remain within the CCF, however.

- Customs - The inspection of cargo by Irish Customs authorities should occur at a centralized customs inspection area, in the CCF but also at separate facilities at later development stages. For large foreign forwarders and 3PL's at the ALH, customs may be located in these private facilities as was described for Excel at Rickenbacher Airport in Chapter 1. Customs requires office space for their inspectors, an accumulation area for cargo being inspected and cleared, and offices with public access and cross-docking facility where shipments may be released.
- Aircraft Maintenance - Shannon International Airport already possesses an excellent heavy maintenance facility. Despite the current aviation industry downturn there is no doubt the 21st century will witness a strong growth in cargo and passenger aircraft. Given Shannon's strategic location, a second heavy maintenance facility may be warranted down the road and space in the airport operating area should be reserved.

IV. Intermodal Interfaces

A major process element of the ALH is the interconnection and integration of multiple modes of transport (air, ocean, 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 ALH connector (the "glue" that connects the various transportation modes) is a cargo transfer system. 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, rail or tram) depending on the relative configuration of the elements of the ALH and the level of activity.

IV-1. Guidelines for On-Site Transportation Connectivity

The CCF would need to interface with the following modes of transportation: 1) air, via Shannon's taxiways; 2) truck, with adequate cross-docking at the CCF and other CCA facilities, as required to meet trucking demand forecasts; 3) sea, with connection to River Shannon ports; and 4) rail, by first providing a rail access and an intermodal terminal at the ALH, 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 ALH production and distribution facilities, as well as an inland port. These intermodal interfaces are illustrated in Exhibit 2.4.

Because the predominant mode of Atlantic Arc transportation for products moving to and from Shannon International Airport domestically would be via highways, truck terminal facilities and facility cross-docks at the ALH along with ring road links to major regional highways would be critical design elements for successful operation of the ALH (see Exhibit 2.1).

IV-2. Guidelines for International Connectivity

The Atlantic Arc agile logistics system must be able to accommodate a broad variety of transportation origins and destinations to and from the ALH. Flow paths of domestic and international air, ocean, truck and rail (when present) modes are represented in Exhibit 2.5 as they might occur between the ALH and domestic or international origins and destinations. Flow paths of intra-ALH cargo are shown within the boundaries of the ALH in the Exhibit. Sea links and an air cargo terminal are included as nodes of the cargo transfer system. Truck and rail (when present) terminals, separate from the Central Cargo Facility, may locate near manufacturing or distribution tenants as the ALH develops in later phases.

Regional truck and rail transportation should be available between all major Atlantic Arc commercial nodes and the ALH. Truck shipments consigned to ALH tenants will most likely be delivered directly to those tenants. Deliveries to consignees located further from the ALH 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 Shannon ALH (i.e., outside of the CCA).

Direct rail transportation lines to and from the ALH and origins and destinations throughout the Atlantic Arc region will eventually be required if the ALH is to achieve its full development potential. Also to be considered is the eventual provision of spur rail lines to larger industrial or distribution facilities that may have a high dependence on rail transportation.

Transportation to and from international origins and destinations both through a future ALH-type network linking Shannon to the Americas, Asia, and the rest of Europe will be provided by air and ocean transport. Some of this will likely go through other Irish ports or even be transited through Dublin International Airport, in addition to that air freighted directly from Shannon. (See Exhibit 2.5 titled "Transportation Linkages between ALH and Domestic and International Cargo Network")

IV-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 ALH operators, tenants, logistics service providers, the Ireland's Department of Customs. The ALH 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 multimodal carrier systems to provide on-line tracking and tracing capability for the shipper. A key function of this system should be to interface with Irish Customs. The local ALH 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 Shannon's ALH 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 Atlantic Arc region.
- Allow the Atlantic Arc community to connect to the Shannon ALH via a network backbone without long distance charges;
- Ensure connectivity by providing enough bandwidth and connection channels;
- Ensure capacity so that the Atlantic Arc community and ALH 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., workstations with high-speed network access, mobile computing and data exchange via secure wireless networking) to connect to the Shannon ALH's network.
- Allow Shannon ALH tenants and the Atlantic Arc user community to access applications (e.g., database inquiries/updates) on a range of different computers operated by third party entities.

Conceptually, the ALH Communication System can be viewed in Exhibit 2.6. This exhibit presents a view of a possible global communication

system for the Shannon ALH. 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 Shannon ALH, 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.

IV-4. Need for Message Standards and Open Architectures

EDIFACT is gradually emerging as the message standard for EDI although its use is far from universal. Web-based open-architecture designs provide the flexibility and interoperability necessary for the Shannon ALH to handle the present and future communication requirements of its likely wide variety of tenants as well as users throughout Atlantic Arc region. And, carriers, shippers, and other transportation service providers have adopted EDI at an increasing rate. Despite certain shortcomings, logisticians are unanimous in their opinion that EDI will remain an essential part of doing business in the future. Tremendous opportunities exist for the Shannon ALH to facilitate, and act as a catalyst for, wider adoption of harmonized EDI among tenant organizations and regional users. To that end, a time-phased web-based, open architecture strategy is essential to guide Shannon ALH users toward the attainment of the total plug-in communications vision.

To engage in EDI, business partners must add three components to their existing computer systems: EDI standards, EDI translation software, and some sort of transmission capability. The following are the main issues driving future EDI development, propagation, and acceptance:

- Message Standards: World-wide unification of standards and more comprehensive number of message types to meet customer needs without uncontrollable proliferation of proprietary programs;
- Translation Software: Linking incompatible message standards/protocols, screen formatting, and print formatting;
- Value Added Network Development: Vendor created networks that offer message translation, protocol translation, databases, and other services;
- Global Digital Network Improvement: Improving the performance and accuracy of the data being transmitted;
- Open Systems: Standards for architectures that allow communication between different vendor systems;
- Real-time EDI Development: Using current data rather than batch downloaded "data pictures." Can be accomplished through event-driven, interactive, or fast-batch EDI. Event-driven means that some action, such as transferring a package from an air carrier to a truck line, causes an updated EDI message to be sent. Interaction EDI occurs when there is a direct on-line conversation between computer systems. Fast-batch EDI exists when updates are gathered for a short time (to the user, it may appear instantaneous), then sent electronically as a small batch;
- Modeling Tools: Computer Aided Software Engineering (CASE) type tools allowing for efficient development, and
- International Acceptance: Removal of restrictions in international telecommunications and trade.

The ultimate objective should be the development of an Atlantic Arc communication system allowing every entity in the region involved in

transporting cargo from supplier to customer to communicate electronically. This outcome should also eliminate all paper transactions and allow for 100% intermodal tracking of cargo throughout the regional and global logistics pipeline.

V. ALH Planning Integration Strategy

As described in the previous sections, the ALH represents a new kind of logistical center in which information technology, 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 Shannon 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, independently produced a master plan for ports, highways, and the airport. 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 a port or 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, logistical synergies need to be emphasized such as sea-air linkages that have been successfully implemented at other sites around the world, such as Singapore, Dubai and Seattle-Tacoma. This will involve a close coordination and

integration of all elements infrastructure planning for the Shannon ALH and Atlantic Arc region.

2. Identify New Elements of the ALH. The ALH 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. 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 multimodal transportation and industrial capabilities at the Shannon ALH and throughout the Atlantic Arc region.
3. Establish New Linkages Between Infrastructure Elements. The creation of a 21st century business environment at Shannon International Airport requires new linkages among key infrastructure elements. Uninterrupted flows of products and materials through the Shannon ALH require the integration of 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 Shannon ALH.

VI. Designing for Future Tenant Needs

Business Process Needs of Tenants

The ultimate success of ALH will depend on how well it meets the business needs of future tenants. The real customer for the planning process is not Shannon Development or Aer Rianta or any government body, but firms Shannon Development and other regional development organizations wish to 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 Shannon ALH and regional infrastructure. These businesses need the following:

- **Paperless Environment.** Companies are 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 increasingly requiring that their suppliers communicate electronically, and the availability of access to global communications and information networks will qualify future ALH tenants, large and small, for new 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 state-of-the-art 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 24 to 36 hours anywhere across the globe. Traditionally, manufacturers seek suppliers that are located near the manufacturing site. 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 be 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 be a required standard of doing business in the near future.

In sum, successful development of Shannon's intermodal and information technology systems will require a broad understanding of the basic business processes of tenants, users, and logistics service providers, their current information system capabilities, and future technology/business needs. These include better understanding of the emerging needs of information-rich industries such as software packaging, financial services, transport-related services such as intermodal logistics and trading and transshipment, strategic and high-growth industries such as auto parts, micro-electronics, pharmaceuticals, and telecommunications, and even hospitality industries, such

as hotels, tourism, and recreation that will form the service backbone of airport-driven commercial development.

Attracting manufacturers, assemblers, and distribution industries will also require a thorough understanding of modern supply chain management principles and the order-to-delivery process. To offer a truly marketable competitive advantage, the Shannon Airport Authority with the assistance of Shannon Development should bring together experts in logistics and supply chain management, multimodal infrastructure development, and information technology to work to create the design specifications that properly integrate all system elements. Few locations in Europe are doing this, so Shannon Development can have a first-mover advantage in attracting high value-adding industries if it takes the lead in seizing this opportunity.

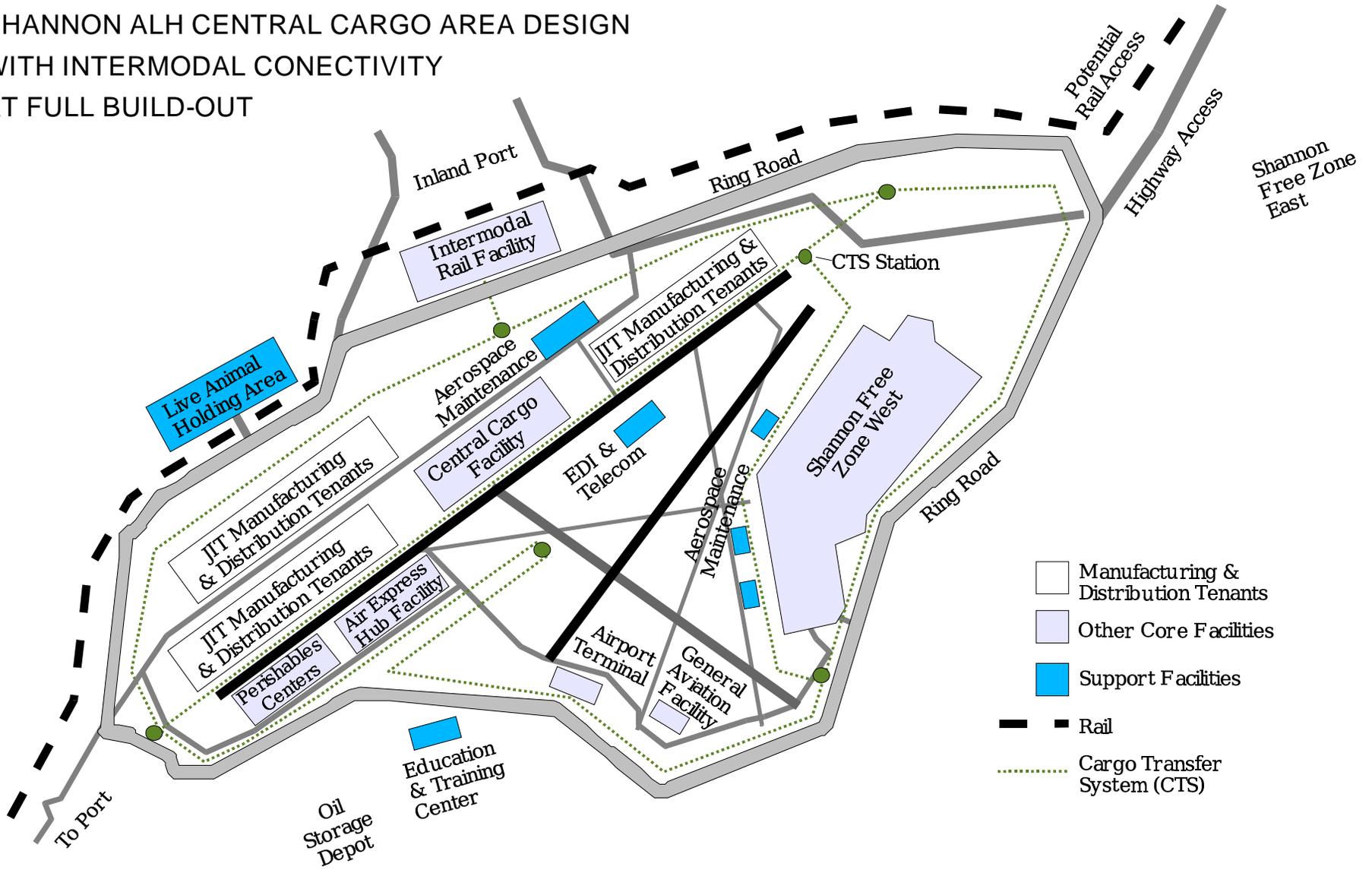
EXHIBIT 2.1

HIGHWAY LINKAGE IN THE SHANNON AIRPORT AREA



EXHIBIT 2.2

SHANNON ALH CENTRAL CARGO AREA DESIGN
WITH INTERMODAL CONECTIVITY
AT FULL BUILD-OUT



- Manufacturing & Distribution Tenants
- Other Core Facilities
- Support Facilities
- Rail
- ⋯ Cargo Transfer System (CTS)

EXHIBIT 2.3 SHANNON ALH CENTRAL CARGO FACILITY

KEY

INCOMING SHIPMENTS OUTGOING SHIPMENTS

- Immediate ■ Immediate
- Imminent ■ Imminent
- Short Term Storage ■ Short Term Storage

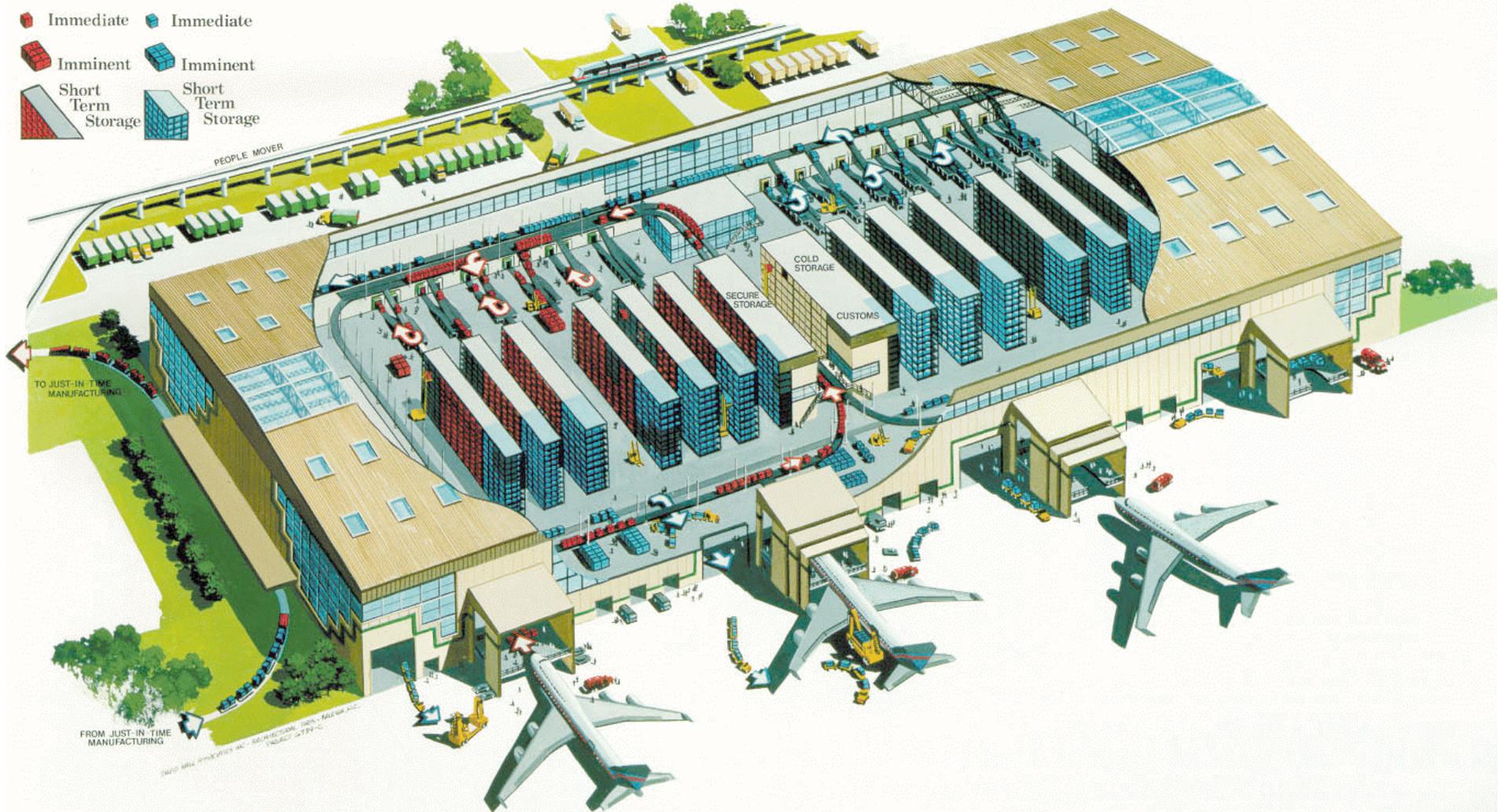


EXHIBIT 2.4 INTERMODAL INTERFACES AT THE SHANNON ALH

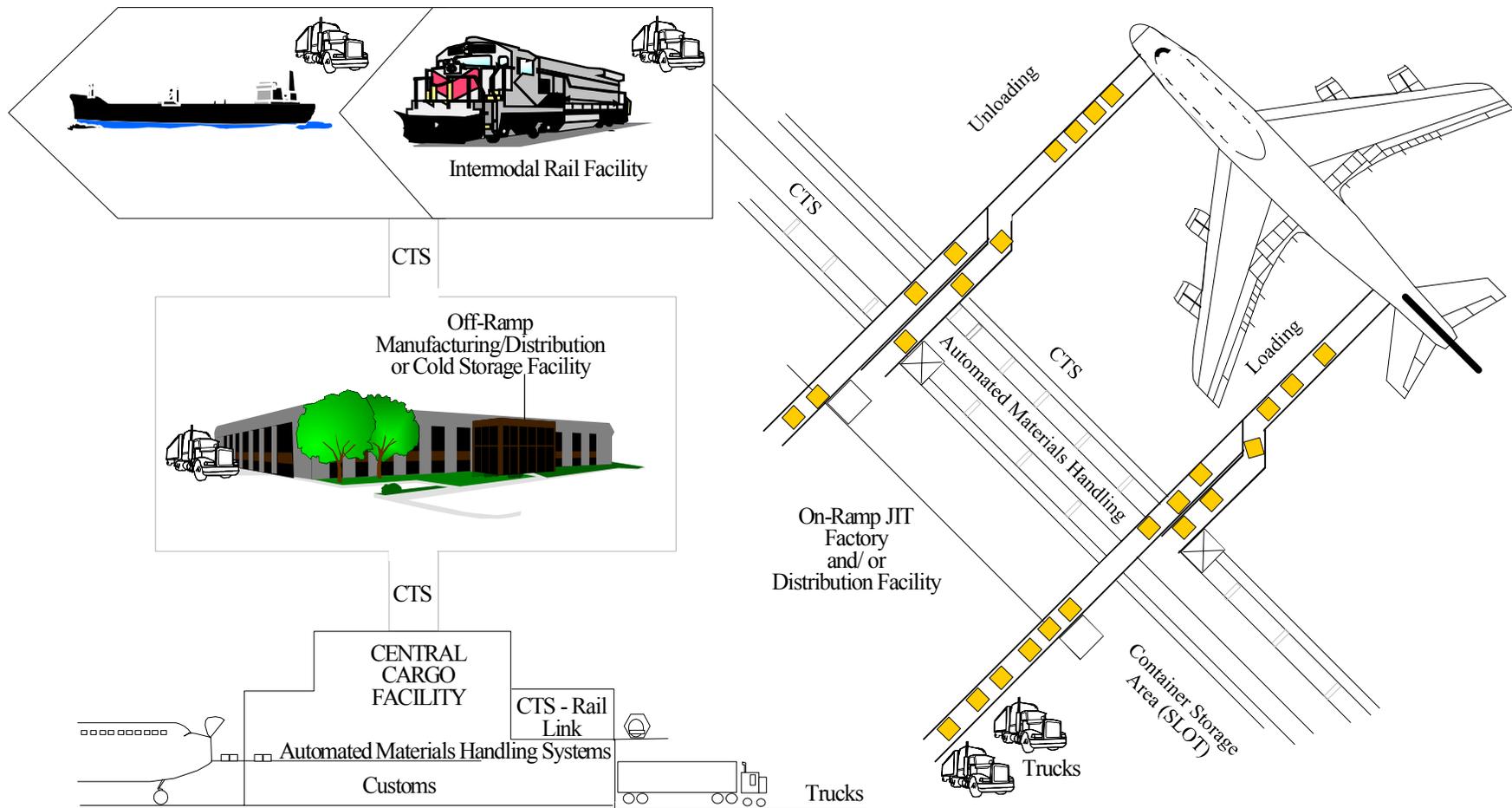


EXHIBIT 2.5 TRANSPORTATION LINKAGES BETWEEN SHANNON ALH AND DOMESTIC AND INTERNATIONAL CARGO NETWORK

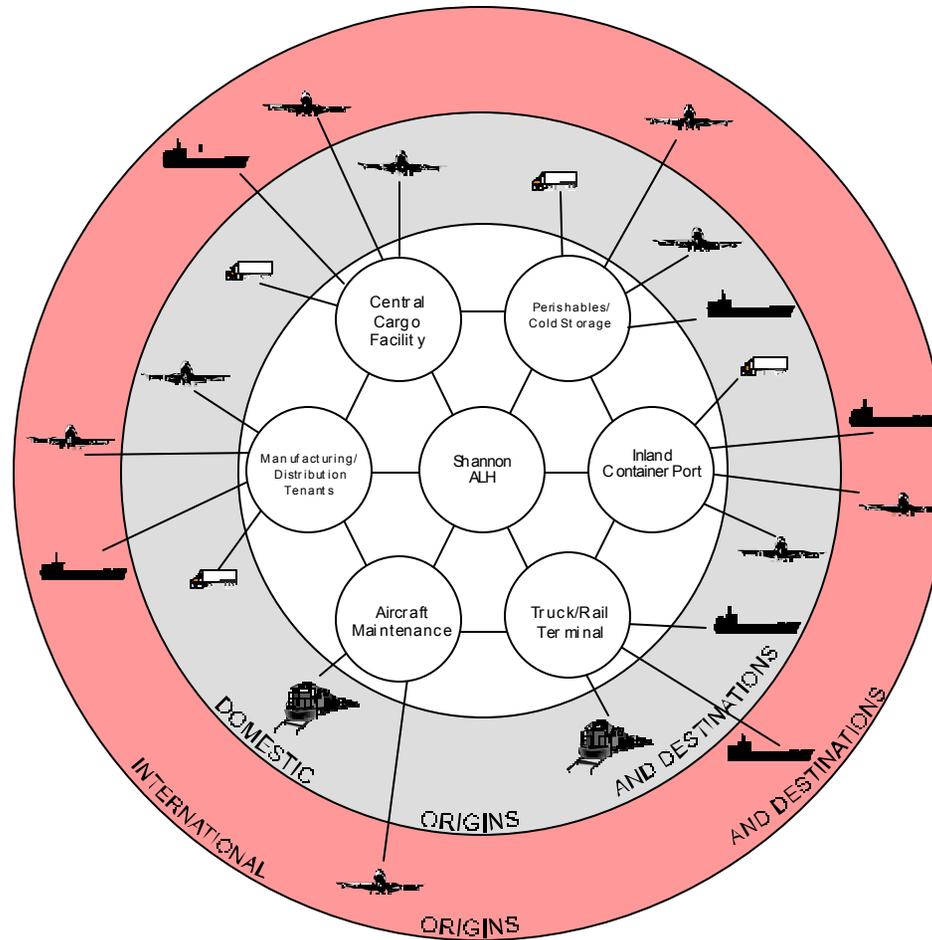
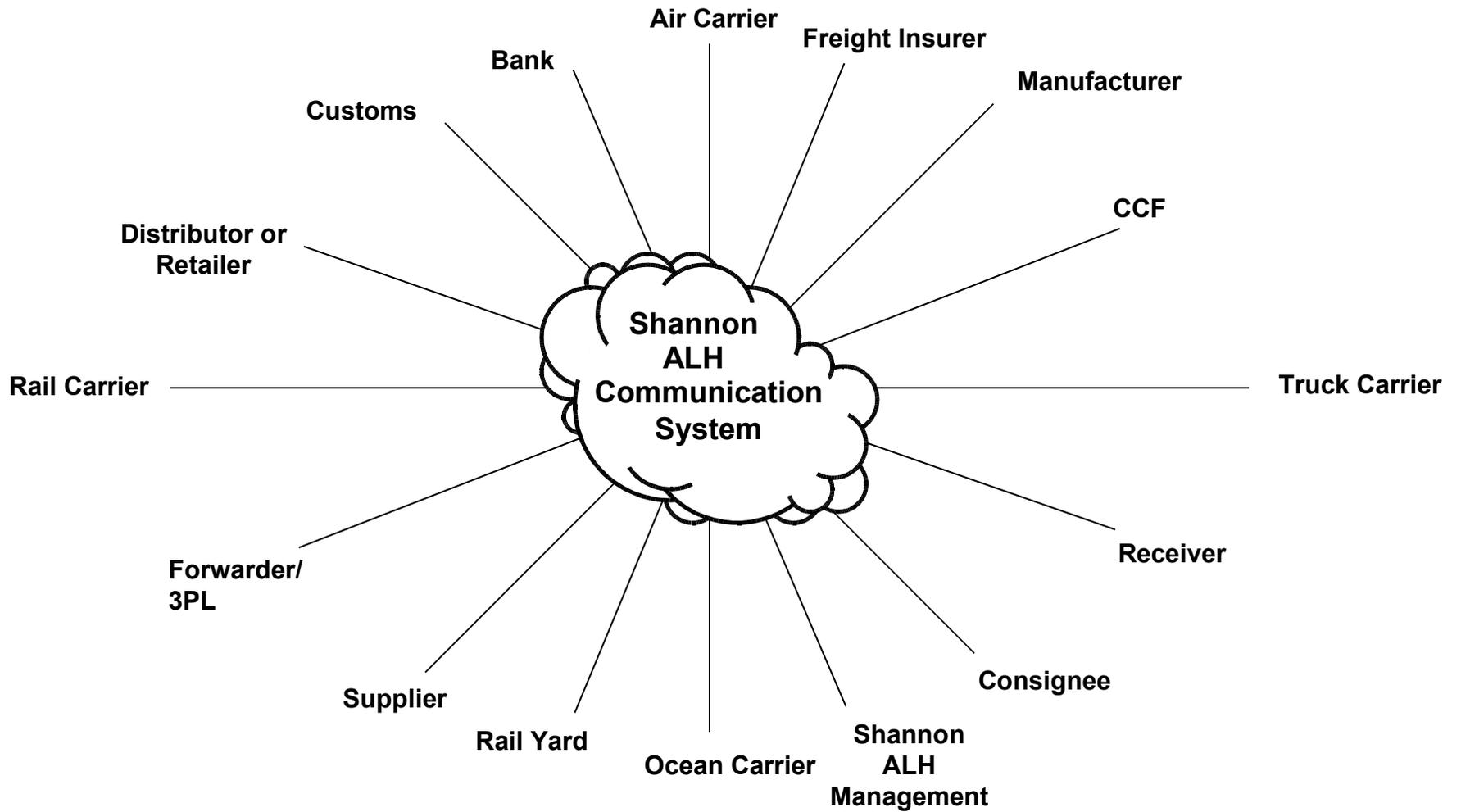


EXHIBIT 2.6
VIEW OF SHANNON ALH COMMUNICATION SYSTEM



Chapter 3

Shannon Agile Logistics Hub Business Plan Guidelines

I. Introduction

The ability of Atlantic Arc companies to respond rapidly and flexibly to growing international markets will depend not only on internal management and operational changes but also on the creation of the external business environment that makes new commercial practices possible. Exhibit 3.1 identifies the key resource needs for a competitive business environment at the Shannon ALH and broader region.

II. Business Resource Needs

First, agile logistics success depends on multimodal transportation systems for fast and flexible supply chain management. Seamlessly connected multimodal 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 modern seaports, efficient highways and rapid railways are needed to support the development of logistics parks, industrial parks, distribution centers, and to more efficiently link them to their sourcing, production and customer networks. For example, the ability of Atlantic Arc agribusiness firms to get fresh produce to and from distant markets quickly and reliably requires cross-docking facilities that link surface transport from across the region with Shannon's aircraft bound for overseas markets. Similarly, manufacturers require cross-docking facilities that bring raw materials, parts, components, and semifinished goods efficiently

to production sites, and facilitate the rapid shipment of assembled products to distant customers.

The automotive industry is a good example of how the proper convergence of local logistical networks and global ocean and air routes can attract a major industry. Heavy metal components would arrive through deep-water ports. At the same time smaller high-value custom components, often made by regional suppliers, must be delivered on a just-in-time basis to the assembly facility. These may arrive from local suppliers by truck and from long-distance suppliers by air. The newly assembled automobiles are then trucked or transported by rail to the port for shipment to international markets.

Second, the Shannon ALH and regional logistics network require an integrated telecommunications network as described in the previous chapter to obtain information on markets and orders, manage materials and inventory, and deliver goods quickly to customers regionally and worldwide. Such a network is also essential to attracting more sophisticated transportation-related and 3PL companies and 4PLs (advanced telecommunications logistics support firms) to Shannon that will provide state-of-the-art logistics services to Shannon ALH users and tenants. The ALH telecommunications system will feature multimedia technologies served by fiber optics loops, RFID, and GPS satellite linkages that connect companies at Shannon and throughout the region to their suppliers and customers and to their own branches, offices, and partners around the world. A teleport with advanced information and telecommunications management systems will serve customer premise equipment, including rapid worldwide communication, electronic data interchange systems, B2B exchanges, and video conferencing equipment through global broadcasting networks 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.

The ALH 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 ALH concept. Shannon International Airport 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 agricultural products, parts and components, and manufactured goods. To speed approvals, the Shannon ALH should house automated customs inspections and, through joint determination with Irish Customs of appropriate technology, procedures, and staffing levels, it should take the lead in creating highly efficient and effective express customs clearance, 24 hours a day, 7 days a week.

Third, the new business environment requires modern commercial services support. Global manufacturers, assemblers, and distributors must have access to export processing zones (such as Shannon's Free Zones) and in-transit bonded warehouses at distributed points near the airport such as the proposed intermodal rail facility, financial institutions, marketing, sales and employment agencies, legal services, and exposition 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 are also necessary to provide foreign investors with all required licenses, permits, and promotional privileges. Trade and exposition facilities are needed to display and market tenant and regional products, a special opportunity for Shannon. In addition, foreign 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.

Fourth, globally competitive industries must be located near or have 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 global businesses depend are world-class universities such as the University of Limerick providing well-educated professionals and research capacities, and consultancy organizations that help commercialize technology, develop new products, and help manage international activities more effectively. Such knowledge resources have proven to be a strong asset in meeting these objectives as well as attracting science and technology parks geared toward the development of export products. Likewise, an ALH distance education and training facility drawing on the ALH's telecommunications network could provide real-time audio, video and tactile worker training on-site at Shannon (or distributed education and training to facilities throughout the Atlantic Arc region) from almost any location in the world.

III. Functional Requirements of the ALH

The ALH represents integrated responses to the business resource needs described above. To succeed, it must incorporate five broad functional capabilities targeted to these needs. 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. *Multimodal Transportation System with Access to Local and Global Transportation Networks*

On-site terminals and inland ports with efficient intermodal capability must link to Atlantic Arc regional highway and rail systems and with global sea and air transportation networks. Primary integration capability at the ALH must provide a seamless interface between modes and between ALH's tenants and major air cargo and ocean shipping routes so

that goods and materials can flow uninterrupted through the hub quickly, at low cost, and with a minimum of human handling. Efficiently linking all four modes of transportation is essential to establishing a competitive infrastructure at the ALH and to attracting commercial investment.

Examples of critical infrastructure needs at the Shannon ALH:

- Upgrades of highway and rail connectors to the broader region and to ports
- Terminals and/or hubs for all major transportation modes, including an inland dry port
- Intermodal integrators for seamless connections between alternative modes
- Electronic tracking capability from mode to mode

2. *On-site Cargo Processing Capability*

The core of any agile logistical hub must be a cargo processing capability and infrastructure with advanced materials handling that can accommodate the needs of a variety of industries. Flexibility in both the processing capability and location of materials 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 Shannon ALH for standard cargo operating processes, as discussed in Chapter 2, can be provided when it is productivity-driven and justified.

Examples of key infrastructure elements include:

- Central Cargo Facility (CCF) with advanced material-handling systems (MHS)

- High-velocity flow through facilities with air side cargo access and land-side 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 and storage.

3. *On-site Cargo Transport System*

A third need is a cargo transport system that connects the ALH with all transportation modes and terminals (air, sea, rail and road), with each mode to the other, and with free zone and regional manufacturing and distribution facilities, as well as logistics support facilities. These systems can be fully automated, semi-automated or manual depending on 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 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) have all but replaced paper and fax transmissions and many 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, global communications networks and faster switching systems for electronic transmissions. These capabilities and new technologies will greatly facilitate seamless relationships among Shannon ALH's tenants, their suppliers and markets regionally and worldwide. The net effect is to accelerate materials handling, customs processing and product transfers among commercial facilities, aircraft, trucks, and rail cars, as well as to other airports and seaports in Ireland and throughout the globe. A key planning challenge, as described in Chapter 2, is to design a communications system that is flexible enough to support the majority of ALH and Atlantic Arc users, that offers rapid connection to regional 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) capability with open architecture
- Ties to fiber optic and satellite networks
- Wide-area and value-added broadband
- Common web-based architectures and message standards

5. *Access to On-site and Remote Services for Commercial Support, Education, and 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 the Shannon ALH can provide a “one-stop-shop” support for tenant companies.

Similarly, electronic access to education and training facilities throughout the country and the world can provide substantial value to ALH tenants. The proposed distance education facility at the Shannon would provide agile support for training the local labor force by offering tenant companies real-time audio and video access to knowledge and training resources from around the world. For example, if Acer wanted to locate a circuit-board production facility in the Shannon Free Zone or elsewhere in the area, work training could be conducted on site, via simultaneous audio, video, and tactile instruction from headquarters in Taipei.

Examples of such key infrastructure elements:

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

IV. Critical Success Factors for the Shannon ALH

Effective planning requires not only vision but also an appropriate paradigm. Guiding the development of a business plan for the Shannon ALH should be a set of overarching themes that, if followed, will greatly facilitate its ultimate success. Realizing these critical success factors will provide Shannon and the Atlantic Arc region with a major competitive edge in attracting business and industry over many other sites in Europe.

Critical Factor #1

The Shannon ALH Must Be Designed Around Emerging 21st Century Business Practices

Beginning with our frequently repeated fundamental point, planning of the ALH at Shannon must reflect the business practices and processes of 21st century global companies. We noted that dramatic changes are occurring in how companies transact their business, and especially in how manufacturers and logistics providers move goods and materials around 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 multimodal transportation, advanced telecommunications, sophisticated materials handling systems, and state-of-the-art business support services to offer unmatched speed and agility to tenants and users.

Critical Factor #2

Development Plans for ALH Must Give High Priority to Quality of Life Considerations

Unlike most other industrial complexes and logistical centers around the world, the Shannon ALH should be developed as a multi-functional zone that will support not only manufacturing and distribution activities, but also

recreational activities and tourism. This raises the importance of quality of life considerations with respect to its broader environment. By balancing industrial, commercial and environmental factors, the Shannon ALH can provide benefits not only to the companies that locate there, but also to nearby residents and tourists, as well.

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

I stressed in Chapter 2 that planning for a Shannon ALH should not be viewed solely as detailed site and civil engineering plans to guide construction and development. Rather, the master plans 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, Shannon must look to the long-term, with a design that is both environmentally and economically sustainable and can adapt to new business needs and incorporate new technologies and infrastructure advances. A basic planning principle is that the ALH itself be designed as a flexible infrastructure system that can be rapidly adapted to current and future tenant requirements. While the features of the competitive landscape for the near term are clearly in focus, competitive strategies will undoubtedly change over time and Shannon must be able to respond quickly to these new logistical needs and infrastructure requirements. A 10 to 20 year development horizon is not unreasonable to build milestones on.

Critical Factor #4
The ALH Must Establish Synchrony with Other Infrastructure Projects Around the World.

With are moving into an era in which networks of firms compete rather than individual companies. In this new commercial environment, Atlantic Arc

companies and Shannon ALH tenants must be able to access their partners quickly and effectively. This requires synchrony with other air cargo systems around the world and with harmonized communications systems and ground/sea transportation networks. Global players, like FedEx, Lufhansa, UPS, KLM and DHL, are racing to set up efficient and seamless international networks. By attracting such cargo providers and linking to their networks, Shannon will be able to participate more quickly and efficiently in the emerging global economy. Nationally, synergies need to be developed with Dublin and Cork to support mutually reinforcing complementarities rather than direct competition with those sites.

Critical Factor #5

The ALH Must Emphasize the Importance of Logistics-Based Capabilities in Attracting Export-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 global transportation networks and 3PL's will be a major criteria for industrial location. Companies will certainly continue to require traditional investment incentives, such as local investment offsets for land or facilities, tax holidays and workforce training. However, as the competitive priorities of speed and efficient consumer response predominate, the relative attractiveness 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 global networks as on government incentives.

Critical Factor #6

Master Plans Must Demonstrate Regional and Countrywide Benefits of the Shannon Agile Logistical Hub.

In order for the Shannon ALH to obtain the maximum popular and governmental support, development must be positioned as a vehicle for greater Atlantic Arc and Irish economic growth. The creation of an agile logistical hub at Shannon that will attract commercially successful companies is a primary goal of this plan. But, ultimately, the success of the ALH will depend on how its capabilities can leverage Shannon's and businesses throughout the west of Ireland and, indeed, the entire country. In this regard, it is critical that ALH planning recognize and highlight the growing integration of its primary commercial and transportation centers and develop an integrated logistics system plan that builds synergies among regional commercial sites.

V. Marketing Strategy for the Shannon ALH

This section presents a suggested marketing strategy to help Shannon Development attract commercial investors and service providers to the ALH. We assume that for the immediate future, Shannon Development will continue to have the lead role and responsibility for promoting the concept of the ALH and for identifying and attracting viable tenants to the complex. In the next chapter, I will make recommendations regarding potential future organization and management of the Shannon ALH. Here, I will raise the prospect that within the next three years, an ALH authority or private-sector firm would be entrusted with the task of developing and operating the complex on a long-term commercial basis. Among the core functions would be the promotion of the Shannon ALH, 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 chosen for the ALH at Shannon, it

would be expected to have its own approach and techniques to marketing the project.

In view of these assumptions, in the present section I first concentrate on the immediate marketing strategy tasks that fall to Shannon Development in the period prior to the possible involvement of an ALH authority or private site developer. However, it is also understood that Shannon Development may retain responsibility indefinitely for the ALH project. Recognizing this possibility, in this section I also address longer-term marketing goals and issues for the ALH that would be relevant either to an authority, private site developer, or to Shannon Development, if the latter continues to be the entity to promote and to develop the ALH for the life of the project.

1. Phased Marketing Themes

The ultimate objective of the Shannon ALH is to serve as a major European multimodal hub and industrial complex offering tenants and users state-of-the-art logistics, knowledge resources, and commercial support. Based on experience with similar multimodal centers elsewhere, achievement of this goal will mean the ALH at Shannon 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. The kinds of tenants likely to be attracted to the Shannon ALH 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.

a. Near Term

The near term represents a period from the present through the next 2 to 3 years. Based on interviews and surveys of potential users at air cargo airports, the near-term marketing strategy should focus on attracting additional international air cargo carriers, especially the integrated air express carriers (e.g., UPS, FedEx, DHL).

The international air express industry is growing rapidly and is expected to dominate air cargo expansion in the future growing at an average annual rate of 18 percent (see Exhibit 3.2). Their regional hubs often do not have a sufficient cargo or manufacturing base nearby, but they can operate efficiently through sorts. These international air express firms can also operate at the existing Shannon airport without major infrastructure modification.

b. Mid-Term

The mid-term for Shannon ALH development represents roughly the years 3 through 7. This period's marketing strategies should be designed to further boost the air cargo demand at Shannon, and then to expand this demand by progressively widening and deepening the nature of activities located at and near the airport. These strategies are:

- attracting additional charter air cargo service providers to the ALH;
- targeting industrial and commercial users of those air services;
- encouraging improved logistics management; and
- facilitating 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 Shannon ALH operating reputation to make it possible to begin moving the facility toward its next phase of evolution.

(1) Attracting charter air cargo service providers (year 2 to 5)

For the Shannon ALH to attract traditional 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, 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 Shannon ALH to Atlantic Arc industries that are largely airfreight dependent. The intent here will be to persuade the firms not necessarily to relocate to Shannon, but to use the facility as a point for consolidation and transshipment of cargo between Ireland and the rest of Europe, similar to FedEx's Asia hub at Subic Bay. Marketing targets should thus be on freight forwarders or shippers of time-sensitive products in Western Ireland. These include microelectronics companies, pharmaceutical firms, fresh produce, and seafood, and other high value to weight export products. Marketing strategies geared to shippers, freight forwarders, 3PL's and air cargo firms should emphasize the value-added that the Shannon ALH can mean in terms of lower price and more efficient shipment services. During this phase of development, the Shannon ALH will seek to become a much more significant air cargo airport, featuring highly efficient cargo handling and transshipment capabilities.

One major way to get more air cargo service to Shannon would be to push ahead (with the Irish government) to negotiate a full "open skies" policy

for air freighter aircraft even if current bilateral's remain in effect for passenger aircraft. Change of gauge rights should also be provided allowing large air freighters to break down their cargo and distribute it to European cities with smaller gauge aircraft. I will return to this later.

(2) Attracting more logistics service providers to Shannon (year 3 to 6)

Once the Shannon International Airport's cargo expands significantly, marketing should also focus on attracting shippers (i.e., manufacturers and assemblers of export products) and forwarders or third party logistics providers (3PLs) to locate at and around Shannon. 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 manufacturers and assemblers that operate at or near Shannon International Airport. Again, the emphasis will be on showing a set of real cost and service quality advantages for locating at Shannon that are compelling to shippers, forwarders , and 3PLs.

c. Longer Term

The longer term (years 6 to 15 and beyond) will focus on developing Shannon into a full-scale ALH logistical complex and attracting the necessary complement of manufacturers, logistics managers and service providers to accomplish ultimate ALH objectives.

(1) Improved logistics management (years 6 to 10)

Once a core of air cargo firms, shippers and forwarders or 3PLs have located and successfully operated at Shannon ALH, the marketing

emphasis will shift to promoting an extension of the range of value-added logistics management services the ALH offers. From its inception the Shannon ALH will have its current free zone status and in-transit bonded facilities. Pointing to the importance of these features for cost-effective logistics, plus the record of efficiency that Shannon will have established for its tenants and users to date, marketing programs will begin to focus more on the advantages of the ALH in overall logistics management. The marketing emphasis will be on helping industrial and commercial shippers and 3PLs find opportunities at Shannon 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 increase supply-chain management efficiency. The possibilities of performing value-added logistics functions such sequencing, pick and pack, packaging, product labeling and assembly of knock-down product kits will be stressed. The marketing targets during this phase will be the companies already located in the Atlantic Arc, plus the whole spectrum of world class third party logistics providers that serve shippers globally. The Shannon ALH's capabilities in automated warehousing/distribution, electronic data interchange, and electronic tracing-tracking will be underlined for these logistics specialists. The ALH's sales proposition during this phase will not only be price and quality of service advantages, but also the enhancements to the speed and agility of supply chain operations that the Shannon ALH could provide shippers and 3PLs.

(2) Integration of production and logistics (years 10 to 15 and beyond)

Once the Shannon ALH 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 Shannon’s 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. Promotional materials will seek to differentiate Shannon from other industrial-commercial-logistics locations as sharply as possible in terms of the price, quality, speed and agility benefits that it offers. The Shannon ALH will at this point be marketed internationally to the most sophisticated shippers and 3PLs as a site where airfreight dependent manufacturers fully coordinate their supply chains and overall manufacturing capacity with customer demands. The marketing message will also stress the Shannon ALH’s world-class standards in total logistics management practices including fusion of all transportation modes (air, sea, 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 Shannon ALH promotional strategy should be grounded in solid business research and planning. This will involve market research of a generic nature on likely ALH tenants and users, given its stage of development, as well as market research specific to Ireland and the west of Europe. 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 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 Southeast Asia markets conducted by the Kenan Institute Asia in Bangkok identified ten industrial groups that are most likely to utilize the facility. Most of these would no doubt also be the best target industries for the Shannon ALH, as well. They include:

- Semi-conductor and computer chip manufacturers
- Pharmaceuticals
- Computer and electronic sub-assembly manufacturers
- Aircraft parts suppliers and aircraft maintenance services
- Garments, footwear and fashion accessory suppliers
- Specific elements in the industrial supplies business, particularly those supplying machine tools and/or those in the petrochemical industries supplying/manufacturing small volumes of high value products, for example aromatics
- Optics and small precision equipment manufacturers
- Suppliers of perishable products - for example, seafood and fish, live animals and animal parts for traditional medicine, fresh fruit and flowers
- Automotive component manufacturers and spare part suppliers
- Jewelry and watch manufacturers

In targeting these industries and others noted above, there are a number of services that need to be highlighted in a marketing plan for the Shannon ALH. Many have already been discussed, but let me provide a summary list of the key support services to be implemented and leveraged in marketing the Shannon ALH.

- Expedited customs clearance and pre-clearance procedures
- Full electronic data interchange capability
- Expanded processing zone and in-transit bonded status for re-exports
- New highway and rail access to the ALH 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
- Knowledge and education support, including a distance education and worker training facility at the ALH
- Enhanced one-stop servicing for foreign investors
- Governmental incentives and promotional privileges

All of the above need to be woven into both the business plan and the implementation plan for the Shannon ALH. They are not only essential to the marketing effort, but also to developing a successful agile logistics hub and regional network.

VI. Rough Financial Estimates: Costs, Revenues, and Profit Forecasts

To date, no full-scale agile logistics hubs have been completely developed but cost and revenue forecasts have been made as part of master planning feasibility studies conducted for Global TransParks under development or consideration in North Carolina and Thailand. These may serve as a rough first-order estimate for a Shannon ALH, but targeted financial assessment would really need to be focused on Shannon to get meaningful results.

The North Carolina project, located at a large (5,000 acres) underutilized jetport 120 kilometers east of the Research Triangle Park is projected to cost approximately \$130 million to convert to an agile hub with a single long-range runway and \$260 million as a dual-runway complex, requiring a new 11,000 ft runway. If all rail and highway upgrades are included, total cost will be approximately \$300 million.

Basic NCGTP costs include the following: master planning (aviation, infrastructure, industrial, environmental), government approvals and public relations, site acquisition, site preparation, utilities (including power, water supply, sewage treatment, etc.), telecommunications, airport infrastructure (runways, taxiways, ramp areas, control tower, navaids system), central cargo facility, and other basic facilities (e.g., general aviation) intermodal interfaces including truck cross-docking, intermodal rail links and internal road system, operations and maintenance, education and training center (optional), and marketing. The most costly components of the infrastructure are the additional runway, taxiways and ramps (\$110 million if constructed from scratch), the central cargo facility (\$8 million to \$30 million depending on size and extent of automation) and state-of-the-art navaids systems (approximately \$10 million). This is why Shannon International Airport with its existing runways, excellent ramps, and aircraft maintenance complex, telecommunications infrastructure

and utilities in place, has such a cost-effective infrastructure advantage over Global TransParks under development.

Revenues include aircraft landing fees, ramp cargo handling fees, central-cargo facility and warehousing fees, facility rentals and leasing and various concessions. These revenues will be closely tied to cargo volume passing through the ALH making accurate traffic demand forecasts key to financial risk assessment. Summary models of the structure and basics of the financial assessment framework and estimation of GTP demand (both developed by HLB, Inc.) are shown in Exhibits 3.3 and 3.4. In 1999, Dr. David Lewis, President of HLB (Hickling Lewis Brod) and Mr. Robert Schaevitz of HLB Decision Economics prepared a generic set of GTP cost, revenue, ROE and ROI numbers based on industrial airport projects underway. These will be provided later in this chapter.

At this point, let me summarize the results of a detailed GTP cost, revenue, and profit analysis conducted in 1997 by Global TransPark Consultants for the proposed Thailand GTP at U-Taphao, an underutilized former U.S. B-52 base. A set of assumptions undergird the financial analysis conducted as part of its business plan. Based on Thailand's economic conditions, inflation was presumed to average 5.0% per year over a 20 year period, the cost of borrowing was forecast to average 13.5% per year, and the private sector operator requiring a net Return on Equity of 17.5% to 20% - this a result of the perceived high risks associated with a new project. The analysis, conducted in US\$ terms, was converted to Baht at exchange rate of 1.00 US\$ = 30 Baht, which was estimated to be the average conversion value over the next 20 years. Currently the Baht is trading at 39 per \$1.

The underlying theme of the analysis was to determine the likely profitability of a private operating company which would manage the overall GTP operations on the specified lands allocated to the GTP at U-Taphao

International Airport in Thailand. This entails managing and maintaining the initial infrastructure and facilities provided by government as well as providing for, and managing and maintaining, any subsequent expansions in infrastructure facilities. The analysis focused on two major income streams from this activity:

- Rents/leases on land and buildings let to on-site tenants like the carriers, the third party freight service providers and to industries.
- A GTP user royalty or throughout charged on all cargo flowing through the GTP.

The GTP Operating Company is assumed to have a 50% share in an Aircraft and Cargo Ground Handling Common Users Company which will handle aircraft (non-integrated carriers only) while on the ground and will manage the movement of cargo (non-integrated carriers only) on the ground. Aircraft handling constitutes towing, cleaning providing auxiliary power (excluding fueling which is to be provided by the U-Taphao Airport Authority). Cargo handling constitutes loading and unloading the aircraft, hauling cargo between the aircraft and the common users sorting facility, palletizing export cargo and breaking down incoming cargo pallets, sorting cargo, and storing cargo. A common users company is assumed to come on line in year 4. Exhibit 3.5 summarizes the estimated operating revenues directly to the GTP Operating Company and the Aircraft and Cargo Ground Handling Common Users Company. Exhibit 3.6 summarizes the estimated infrastructure and operating costs directly to the GTP Operating Company and the Aircraft and Cargo Ground Handling Common Users Company. Exhibit 3.7 summarizes the estimated operating profits/losses from direct GTP operations plus 50% of Aircraft and Cargo Ground Handling Common Users Company.

Exhibit 3.8 shows a \$1.5 million loss in year one; a \$3.8 million profit in year five; a \$9.9 million profit in year 10 and a \$37 million profit in year 20 (adjusted for inflation). The two yearly dips in profit during the ninth and fourteen years are when additional major infrastructure improvements were forecast.

As noted above, Dr. David Lewis and his colleagues have conducted a U.S. based prototype Global TransPark Pro Forma Financial Analysis based on converting an existing airport to an agile logistics hub. Their analysis covers a twenty-year period in three phases of development: under construction, ramp-up, and mature operations. The analysis yields an average annual ROE of 14.9% and an internal rate of return (after interest) of 18.8%, with a quite respectable debt service coverage ratio. Again, let me stress that these assessments and results have numerous hypothetical elements and are meant only to be illustrative. Were Shannon Development to proceed with a financial feasibility study for the ALH, I would recommend that an investment (full cost-benefit) analysis be conducted as part of that study.

VII. Conclusion

This chapter summarized the main elements that should guide development of a full business plan for a Shannon ALH and highlighted pertinent findings from related studies. Emphasis was on creating a competitive business environment at the ALH, business resource needs, critical success factors, marketing strategies, target industries, and financial factors. Key to this competitive environment will be based capabilities at the ALH and a region-wide integrated logistics network that provides advantages of speed and agility to goods-processing firms throughout the Atlantic Arc region. In the final Chapter (4), I will focus on key elements of an ALH implementation plan and a

set of recommendations, and action steps to design, develop, manage, operate, and otherwise move the project forward.

EXHIBIT 3.1

AGILE BUSINESS ENVIRONMENT OF IRELAND'S ATLANTIC ARC

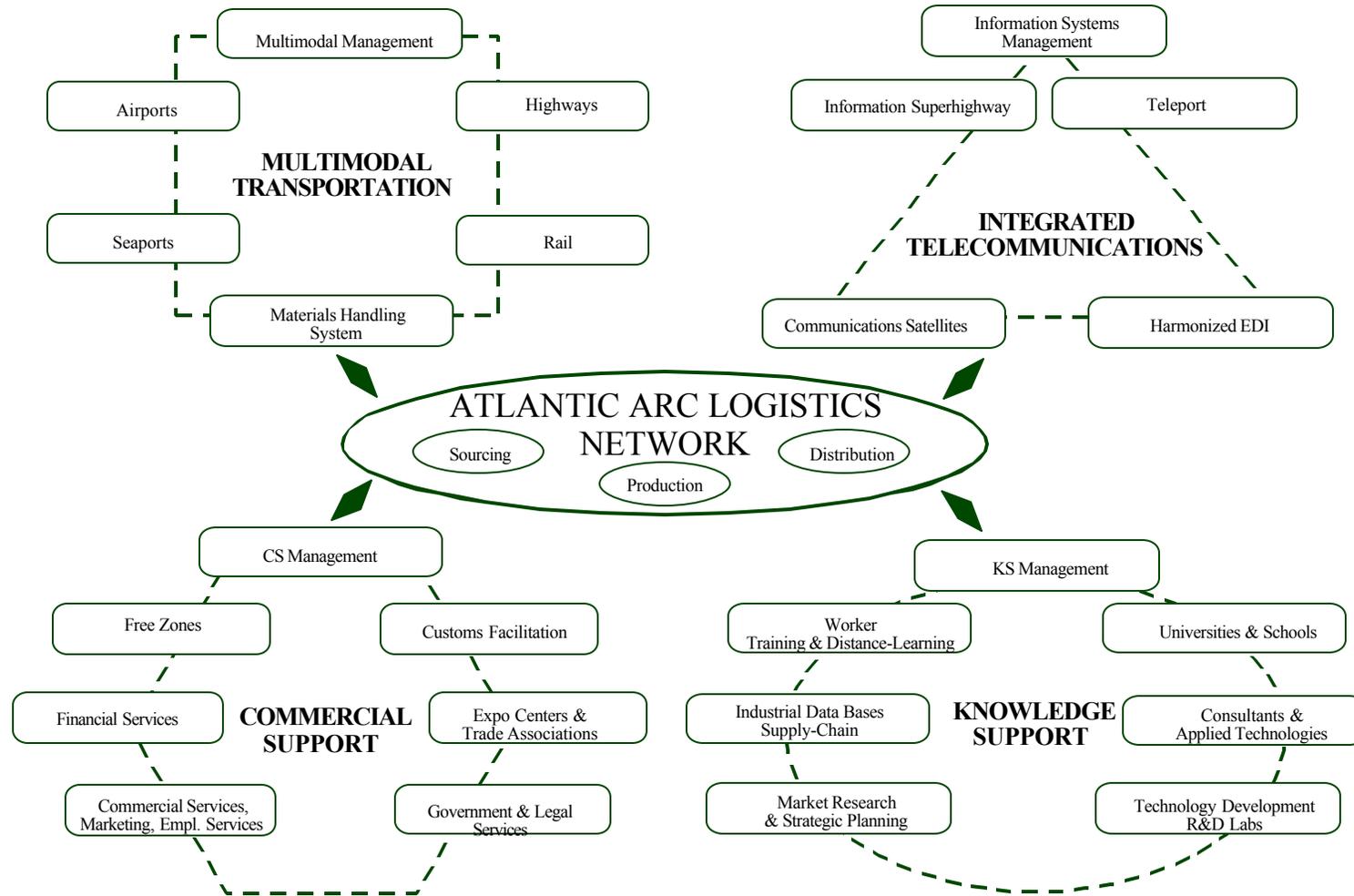
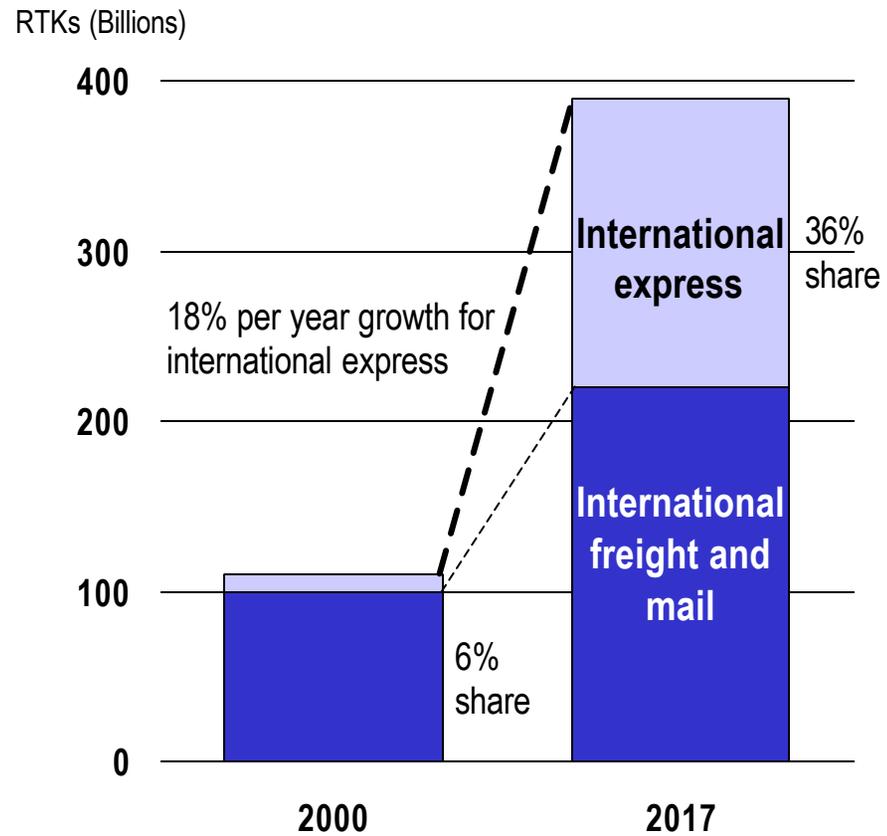


FIGURE 3.2
INTERNATIONAL AIR EXPRESS BECOMING A MAJOR FORCE



Source: Boeing Commercial Airplane Group, Current Market Outlook, 2000

EXHIBIT 3.3

OVERVIEW OF GTP ASSESSMENT FRAMEWORK

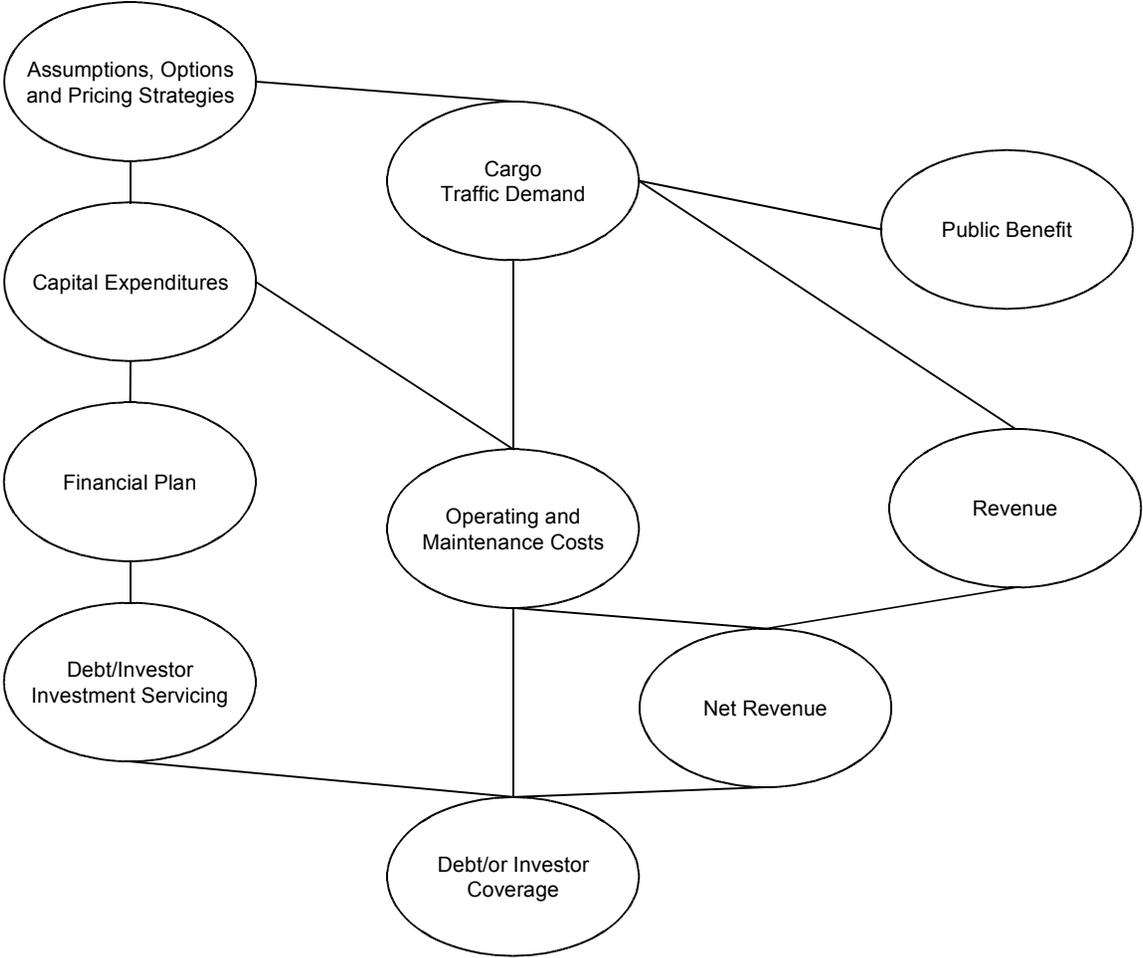


EXHIBIT 3.4
ESTIMATION OF GTP DEMAND

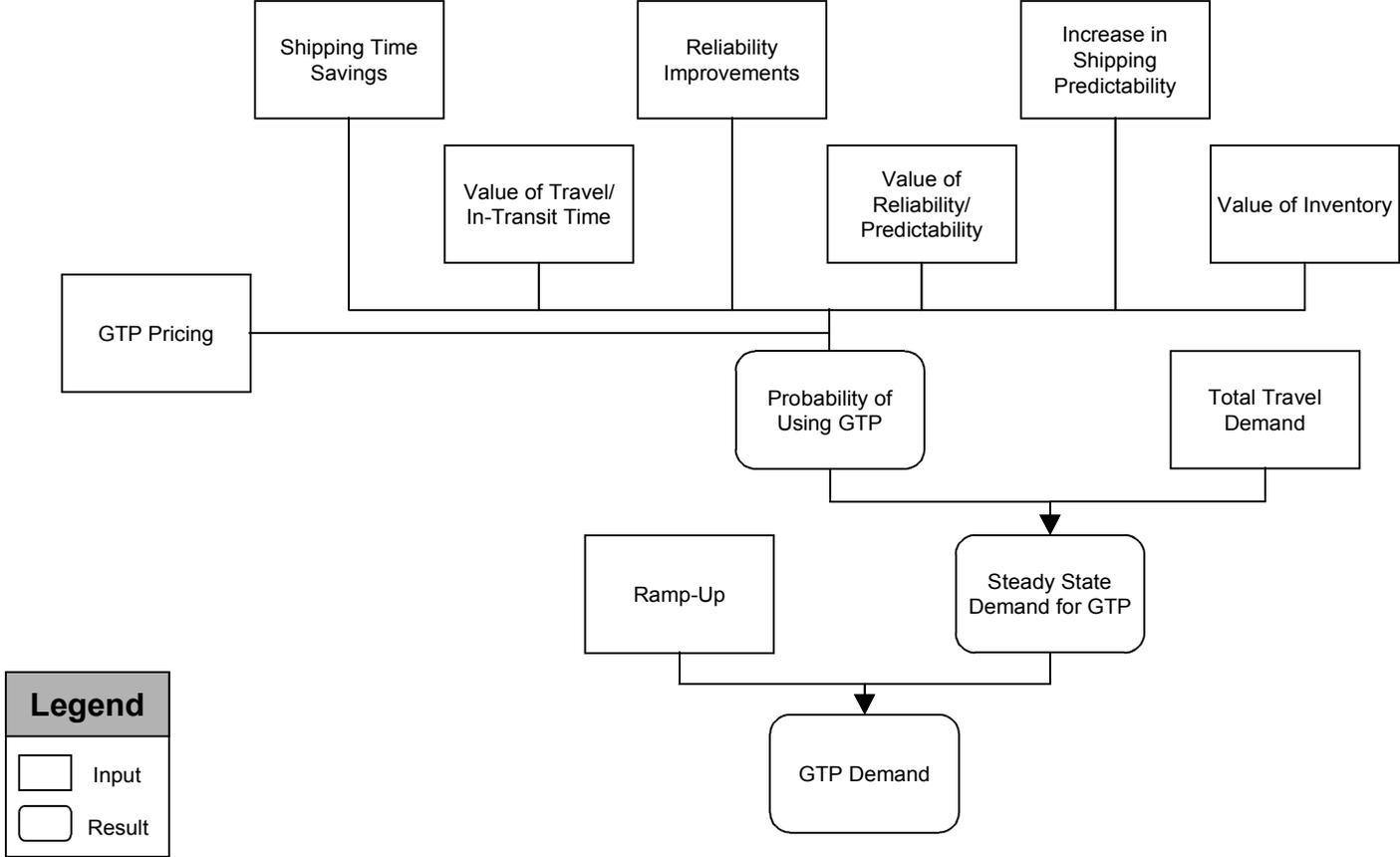


EXHIBIT 3.5

ESTIMATED ANNUAL REVENUE TO THE THAILAND GLOBAL TRANSPARK (MILLION BAHT)

| | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 |
|---|------|------|------|-------|-------|-------|-------|-------|-------|-------|-------|-------|---------|---------|---------|---------|---------|---------|---------|---------|
| Revenues Direct to GTP Operating Company | | | | | | | | | | | | | | | | | | | | |
| Property Management | 0.4 | 1.1 | 2.8 | 10.7 | 13.8 | 20.8 | 30.7 | 35.5 | 41 | 47.5 | 54.4 | 62.2 | 71.2 | 81.5 | 93.3 | 105.1 | 118.5 | 133.7 | 150.8 | 170 |
| Royalties | 2.3 | 4.1 | 10.1 | 38.2 | 53.7 | 79.9 | 113.5 | 131.4 | 152 | 175.9 | 201.3 | 230.3 | 263.6 | 301.7 | 345.4 | 389.4 | 439 | 495.2 | 558.6 | 629.8 |
| Total | 2.7 | 5.2 | 12.9 | 48.9 | 67.6 | 100.7 | 144.2 | 166.9 | 193 | 223.4 | 255.7 | 292.5 | 334.8 | 383.2 | 438.7 | 494.5 | 557.5 | 628.9 | 709.4 | 799.8 |
| Revenues to Aircraft and Cargo Ground Handling Common-User Company – 50% owned by GTP Operating Company | | | | | | | | | | | | | | | | | | | | |
| Aircraft Parking | – | – | – | 2.6 | 3 | 4.7 | 5.9 | 6.9 | 7.9 | 9.1 | 10.4 | 12 | 13.7 | 15.8 | 18 | 20.6 | 23.1 | 26 | 29.4 | 33.5 |
| Aircraft Handling | – | – | – | 13.1 | 13.7 | 20.7 | 26.2 | 30.5 | 35.2 | 40.6 | 46 | 53.1 | 60.8 | 70.1 | 79.6 | 91 | 102.2 | 115 | 130.4 | 148.2 |
| Ramp Handling | – | – | – | 25.1 | 26.3 | 79.5 | 108.9 | 129.6 | 152.1 | 172.3 | 198.6 | 227 | 262.7 | 296.3 | 337.9 | 382.9 | 431.7 | 484.3 | 547.6 | 616.1 |
| Warehouse Throughput | – | – | – | 25 | 26.3 | 40.8 | 65.3 | 75.6 | 87.5 | 101.3 | 115.8 | 132.5 | 151.7 | 173.6 | 198.8 | 224.1 | 252.6 | 285 | 321.4 | 362.4 |
| Storage | – | – | – | 22.3 | 37.8 | 54.8 | 73.2 | 84.8 | 98 | 113.5 | 129.8 | 148.5 | 170 | 194.5 | 222.7 | 251.1 | 283.1 | 319.3 | 360.1 | 406.1 |
| Documentation and Other | – | – | – | 11.7 | 16.9 | 25 | 34.7 | 40.2 | 46.5 | 53.8 | 61.6 | 70.4 | 80.6 | 92.2 | 105.6 | 119 | 134.2 | 151.4 | 170.8 | 192.6 |
| Total | – | – | – | 99.8 | 124.0 | 225.5 | 314.2 | 367.5 | 427.1 | 490.5 | 562.2 | 643.6 | 739.5 | 842.7 | 962.6 | 1,088.8 | 1,226.8 | 1,380.9 | 1,559.8 | 1,758.8 |
| Total Revenue (GTP Operating Company and Aircraft and Cargo Ground Handling Common Users) | 2.7 | 5.2 | 12.9 | 148.7 | 191.6 | 326.3 | 458.4 | 534.5 | 620.1 | 713.9 | 817.9 | 936.0 | 1,074.2 | 1,225.9 | 1,401.3 | 1,583.3 | 1,784.3 | 2,009.8 | 2,269.1 | 2,558.5 |

Source: Global TransPark Consultants
January 1998

EXHIBIT 3.6

ESTIMATED TOTAL ANNUAL COSTS TO THE THAILAND GTP OPERATING COMPANY AND AIRCRAFT AND CARGO GROUND HANDLING COMMON USERS COMPANY (MILLION BAHT)

| | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 |
|---|------|------|------|-------|------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| Costs Direct to the GTP Operating Company | | | | | | | | | | | | | | | | | | | | |
| Expenditure on Infrastructure | 27.2 | 23.2 | 24.3 | 25.5 | 26.8 | 28.2 | 29.6 | 31.1 | 32.6 | 163.3 | 37.3 | 39.1 | 41.1 | 43.1 | 326.6 | 53 | 55.6 | 58.4 | 61.3 | 64.4 |
| Operating & Maintenance | 20.5 | 22.1 | 23.7 | 32.9 | 35.3 | 42.2 | 47.3 | 50.6 | 59.3 | 66 | 70.8 | 81.6 | 90.5 | 96.7 | 110.2 | 122 | 137.8 | 147.1 | 170.5 | 181.9 |
| Total | 47.8 | 45.2 | 48.1 | 58.5 | 62.1 | 70.4 | 76.9 | 81.7 | 91.9 | 229.3 | 108.1 | 120.8 | 131.6 | 139.8 | 436.7 | 175 | 193.4 | 205.5 | 231.8 | 246.3 |
| Aircraft and Cargo Ground Handling Common Users Company | | | | | | | | | | | | | | | | | | | | |
| Ground Rents | - | - | - | 3.7 | 3.9 | 6 | 9.6 | 11.1 | 12.8 | 14.9 | 17 | 19.4 | 22.2 | 25.5 | 29.2 | 32.9 | 37.1 | 41.8 | 47.1 | 53.2 |
| Capital | - | - | - | 68.6 | - | 1.6 | 0.8 | 19.5 | 22.3 | - | 67.5 | 1.1 | 1.1 | 32.9 | - | 19.6 | 2.7 | 2.9 | 46.1 | 101.6 |
| Operating & Maintenance | - | - | - | 22.9 | 30.1 | 50.5 | 56.6 | 76.8 | 82.5 | 92.2 | 120.8 | 160.8 | 172.6 | 190.7 | 235.6 | 255.6 | 311.7 | 335.4 | 412.3 | 491 |
| Total | - | - | - | 95.2 | 33.9 | 58.1 | 67 | 107.4 | 117.6 | 107 | 205.3 | 181.3 | 196 | 249 | 264.7 | 308.1 | 351.5 | 380 | 505.5 | 645.8 |
| Total Costs | 47.8 | 45.2 | 48.1 | 153.7 | 96.1 | 128.5 | 143.9 | 189.1 | 209.5 | 336.3 | 313.4 | 302 | 327.5 | 388.9 | 701.4 | 483.1 | 544.9 | 585.6 | 737.3 | 892.1 |
| (GTP Operating Company and Aircraft and Cargo Ground Handling Common Users) | | | | | | | | | | | | | | | | | | | | |

Source: Global TransPark Consultants
January 1998

EXHIBIT 3.7

ESTIMATED ANNUAL PROFIT/LOSS: THAILAND GTP OPERATING COMPANY (MILLION BAHT)

| | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 |
|---|--------|--------|--------|-------|------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|---------|---------|
| Operating Profit/Loss | | | | | | | | | | | | | | | | | | | | |
| GTP Direct Operations | (45.1) | (40.1) | (35.2) | (9.5) | 5.5 | 30.3 | 67.3 | 85.2 | 101.1 | (5.9) | 147.6 | 171.7 | 203.2 | 243.3 | 1.9 | 319.6 | 364.1 | 423.4 | 477.6 | 553.5 |
| Share (50%) of Common Users Company's Profits | - | - | - | 2.3 | 45.0 | 83.7 | 123.6 | 130.1 | 154.8 | 191.7 | 178.5 | 231.1 | 271.8 | 296.8 | 348.9 | 390.4 | 437.7 | 500.4 | 527.1 | 556.5 |
| Total | (45.1) | (40.1) | (35.2) | (7.2) | 50.5 | 114.1 | 190.9 | 215.3 | 255.9 | 185.9 | 326.0 | 402.8 | 474.9 | 540.2 | 350.9 | 709.9 | 801.7 | 923.8 | 1,004.7 | 1,110.0 |

Source: Global TransPark Consultants
January 1998

EXHIBIT 3.8 — *CONTINUED*

PROTOTYPE GLOBAL TRANSPARK NON-GREENFIELD SITE PRO FORMA FINANCIAL ANALYSIS
SCENARIO — 80/20 DEBT/EQUITY
DECEMBER 1998

(All Figures in Nominal US\$Millions)

| | Under Construction | | | Ramp-Up | | | Mature Operations | | | | |
|---|--------------------|---------|---------|---------|----------|----------|-------------------|----------|----------|----------|----------|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
| 51 DEBT SERVICE (20-Yr Level Amort) | | | | | | | | | | | |
| 52 Inflation Rate | 100.0% | 96.6% | 93.4% | 90.2% | 87.1% | 84.2% | 81.4% | 78.6% | 75.9% | 73.4% | 70.9% |
| 53 Principal | \$0.0 | \$0.0 | \$0.0 | (\$2.5) | (\$6.1) | (\$9.4) | (\$9.1) | (\$8.8) | (\$8.5) | (\$8.2) | (\$7.9) |
| 54 Interest | \$0.0 | \$0.0 | \$0.0 | (\$4.1) | (\$9.6) | (\$14.5) | (\$13.3) | (\$12.1) | (\$10.9) | (\$9.9) | (\$8.9) |
| 55 TOTAL | \$0.0 | \$0.0 | \$0.0 | (\$6.6) | (\$15.7) | (\$24.0) | (\$22.4) | (\$20.9) | (\$19.4) | (\$18.1) | (\$16.8) |
| 56 Debt Schedule Calculations | | | | | | | | | | | |
| 57 Bond Size Calculations | | | | | | | | | | | |
| 58 Issue Year 1 (8.5%, 3y Capl; 2% COI) | \$56.0 | \$0.0 | \$0.0 | \$0.0 | \$0.0 | \$0.0 | \$0.0 | \$0.0 | \$0.0 | \$0.0 | \$0.0 |
| 59 Issue Year 2 (8.5%; 3y Capl; 2% COI) | \$0.0 | \$84.0 | \$0.0 | \$0.0 | \$0.0 | \$0.0 | \$0.0 | \$0.0 | \$0.0 | \$0.0 | \$0.0 |
| 60 Issue Year 3 (8.5%; 3y Capl; 2% COI) | \$0.0 | \$0.0 | \$84.0 | \$0.0 | \$0.0 | \$0.0 | \$0.0 | \$0.0 | \$0.0 | \$0.0 | \$0.0 |
| 61 Annual Total | \$56.0 | \$84.0 | \$84.0 | \$0.0 | \$0.0 | \$0.0 | \$0.0 | \$0.0 | \$0.0 | \$0.0 | \$0.0 |
| 62 Cumulative Total | \$56.0 | \$140.0 | \$224.0 | \$224.0 | \$224.0 | \$224.0 | \$224.0 | \$224.0 | \$224.0 | \$224.0 | \$224.0 |
| 63 Interest Calculation – Principal Basis | | | | | | | | | | | |
| 64 Issue Year 1 | \$0.0 | \$0.0 | \$0.0 | \$53.2 | \$50.4 | \$47.6 | \$44.8 | \$42.0 | \$39.2 | \$36.4 | \$33.6 |
| 65 Issue Year 2 | \$0.0 | \$0.0 | \$0.0 | \$0.0 | \$79.8 | \$75.6 | \$71.4 | \$67.2 | \$63.0 | \$58.8 | \$54.6 |
| 66 Issue Year 3 | \$0.0 | \$0.0 | \$0.0 | \$0.0 | \$0.0 | \$79.8 | \$75.6 | \$71.4 | \$67.2 | \$63.0 | \$58.8 |
| 67 Annual Total | \$0.0 | \$0.0 | \$0.0 | \$53.2 | \$130.2 | \$203.0 | \$191.8 | \$180.6 | \$169.4 | \$158.2 | \$147.0 |
| 68 Retirement Schedule | | | | | | | | | | | |
| 69 Issue Year 1 | \$0.0 | \$0.0 | \$0.0 | \$2.8 | \$2.8 | \$2.8 | \$2.8 | \$2.8 | \$2.8 | \$2.8 | \$2.8 |
| 70 Issue Year 2 | \$0.0 | \$0.0 | \$0.0 | \$0.0 | \$4.2 | \$4.2 | \$4.2 | \$4.2 | \$4.2 | \$4.2 | \$4.2 |
| 71 Issue Year 3 | \$0.0 | \$0.0 | \$0.0 | \$0.0 | \$0.0 | \$4.2 | \$4.2 | \$4.2 | \$4.2 | \$4.2 | \$4.2 |
| 72 TOTAL | \$0.0 | \$0.0 | \$0.0 | \$2.8 | \$7.0 | \$11.2 | \$11.2 | \$11.2 | \$11.2 | \$11.2 | \$11.2 |
| 73 Debt Outstanding (Year End) | \$56.0 | \$140.0 | \$224.0 | \$221.2 | \$214.2 | \$203.0 | \$191.8 | \$180.6 | \$169.4 | \$158.2 | \$147.0 |

EXHIBIT 3.8 — CONTINUED
PROTOTYPE GLOBAL TRANSPARK NON-GREENFIELD SITE PRO FORMA FINANCIAL ANALYSIS
SCENARIO — 80/20 DEBT/EQUITY
DECEMBER 1998

| (All Figures in Nominal US\$Millions) | Mature Operation | | | | | | | | | GRAND TOTALS |
|--|------------------|----------|----------|----------|----------|----------|---------|---------|---------|-----------------|
| | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | |
| 51 DEBT SERVICE (20-Yr Level Amort) | | | | | | | | | | |
| 52 Inflation Rate | 68.5% | 66.2% | 63.9% | 61.8% | 59.7% | 57.7% | 55.7% | 53.8% | 52.0% | — |
| 53 Principal | (\$7.7) | (\$7.4) | (\$7.2) | (\$6.9) | (\$6.7) | (\$6.5) | (\$6.2) | (\$6.0) | (\$5.8) | (\$121.0) |
| 54 Interest | (\$7.9) | (\$7.0) | (\$6.2) | (\$5.4) | (\$4.6) | (\$3.9) | (\$3.2) | (\$2.6) | (\$2.0) | (\$126.1) |
| 55 TOTAL | (\$15.6) | (\$14.4) | (\$13.3) | (\$12.3) | (\$11.3) | (\$10.4) | (\$9.5) | (\$8.7) | (\$7.9) | (\$247.2) |
| 56 Debt Schedule Calculations | | | | | | | | | | |
| 57 Bond Size Calculations | | | | | | | | | | |
| 58 Issue Year 1 (8.5%, 3y Capl; 2% COI) | \$0.0 | \$0.0 | \$0.0 | \$0.0 | \$0.0 | \$0.0 | \$0.0 | \$0.0 | \$0.0 | \$56.0 |
| 59 Issue Year 2 (8.5%; 3y Capl; 2% COI) | \$0.0 | \$0.0 | \$0.0 | \$0.0 | \$0.0 | \$0.0 | \$0.0 | \$0.0 | \$0.0 | \$84.0 |
| 60 Issue Year 3 (8.5%; 3y Capl; 2% COI) | \$0.0 | \$0.0 | \$0.0 | \$0.0 | \$0.0 | \$0.0 | \$0.0 | \$0.0 | \$0.0 | \$84.0 |
| 61 Annual Total | \$0.0 | \$0.0 | \$0.0 | \$0.0 | \$0.0 | \$0.0 | \$0.0 | \$0.0 | \$0.0 | \$224.0 |
| 62 Cumulative Total | \$224.0 | \$224.0 | \$224.0 | \$224.0 | \$224.0 | \$224.0 | \$224.0 | \$224.0 | \$224.0 | — |
| 63 Interest Calculation – Principal Basis | | | | | | | | | | |
| 64 Issue Year 1 | \$30.8 | \$28.0 | \$25.2 | \$22.4 | \$19.6 | \$16.8 | \$14.0 | \$11.2 | \$8.4 | \$579.6 |
| 65 Issue Year 2 | \$50.4 | \$46.2 | \$42.0 | \$37.8 | \$33.6 | \$29.4 | \$25.2 | \$21.0 | \$16.8 | \$856.8 |
| 66 Issue Year 3 | \$54.6 | \$50.4 | \$46.2 | \$42.0 | \$37.8 | \$33.6 | \$29.4 | \$25.2 | \$21.0 | \$840.0 |
| 67 Annual Total | \$135.8 | \$124.6 | \$113.4 | \$102.2 | \$91.0 | \$79.8 | \$68.6 | \$57.4 | \$46.2 | \$2,052.4 |
| 68 Retirement Schedule | | | | | | | | | | |
| 69 Issue Year 1 | \$2.8 | \$2.8 | \$2.8 | \$2.8 | \$2.8 | \$2.8 | \$2.8 | \$2.8 | \$2.8 | \$47.6 |
| 70 Issue Year 2 | \$4.2 | \$4.2 | \$4.2 | \$4.2 | \$4.2 | \$4.2 | \$4.2 | \$4.2 | \$4.2 | \$67.2 |
| 71 Issue Year 3 | \$4.2 | \$4.2 | \$4.2 | \$4.2 | \$4.2 | \$4.2 | \$4.2 | \$4.2 | \$4.2 | \$63.0 |
| 72 TOTAL | \$11.2 | \$11.2 | \$11.2 | \$11.2 | \$11.2 | \$11.2 | \$11.2 | \$11.2 | \$11.2 | \$177.8 |
| 73 Debt Outstanding (Year End) | \$135.8 | \$124.6 | \$113.4 | \$102.2 | \$91.0 | \$79.8 | \$68.6 | \$57.4 | \$46.2 | \$2,724.4 |

Source: HLB, Inc.
December 1998

Chapter 4

Guidelines for Development of a Shannon ALH Implementation Plan

I. Introduction

In the previous two chapters, guidelines were provided for ALH infrastructure and facility design and for the development of a Shannon ALH business plan. Building on these two chapters, this chapter will present guidelines for an ALH implementation plan, including elaboration of infrastructure and marketing phasing, incentives to attract and leverage appropriate air cargo service providers and industry, coordination and harmonization with multimodal logistics hubs elsewhere and alternative institutional mechanisms for financing and managing Shannon ALH development and operation.

II. Infrastructure Phasing and Industrial Development Timetable

Whereas the Shannon ALH is conceived ultimately as a fully integrated multimodal transportation, telecommunications, manufacturing, and logistics support complex, the reality is that it will likely evolve over a 5- to 20-year-period through a series of overlapping development stages. Understanding this is necessary to making prudent investments in infrastructure timed to industry demand. Below I summarize key stages of a phased infrastructure and facilities implementation plan.

Stage I

Stage I will be when Shannon Development and the Irish government establish the institutional and legal environment that will affect future ALH development. This includes regulatory and customs issues, land and facility

ownership/leasing and concessionary rights as well as a management structure. These issues will be elaborated later in this chapter. During Stage I, which can last up to three years, initial tenants will also be recruited and basic aviation-related infrastructure improved.

As noted in guidelines for the business plan, the most likely initial tenants will be those that can put their operations on line quickly and relatively inexpensively by utilizing Shannon International Airport's existing infrastructure and facilities. A modern heavy aircraft maintenance facility is already operating at the airport. International air express and air cargo carriers should also be recruited since they can be up and running almost immediately. During this first stage, feasibility analysis and master planning should commence for upgraded highway connectors, a rail link and intermodal rail yard, inland port, the advanced telecommunications systems required in later stages, as well as an on-site education and training center.

Stage II

Stage II (estimated to be a 2 to 5 year period following Stage I) will involve the commencement and/or expansion of integrated air express and air cargo service at Shannon, a critical step to the development of a successful ALH. Service providers would include air express carriers (e.g., FedEx, UPS, DHL), heavy lift charter cargo carriers (Atlas Air Cargo, Polar Air Cargo, Cargolux, Evergreen, etc.) along with freight forwarders supporting cargo airlines and shippers. At this stage, the ALH will serve primarily as an 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 Shannon 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 expedited customs clearance technology and pre-clearance procedures, in-transit bonded facilities and improved multimodal surface transportation linkages to the site and to the River Shannon Port.

One of the critical paths to attracting new manufacturing and distribution tenants to the Shannon ALH will be by offering tenants and users quicker, cheaper and more efficient customs clearance, including pre-clearance procedures and paperless electronic data interchange (EDI), as well as rapid cargo security clearance. The Shannon ALH must also provide an expanded commercial environment (Free Zone) for export processing without duties and customs clearance requirements. Its Free Zone East and West should be complemented by in-transit bonded warehouses and production (assembly) status at or near the ALH.

As noted, multimodal surface connectors are likewise critical to moving the ALH to the manufacturing-assembly stage and should be implemented during Stage II. These include upgraded regional highway and rail links to the ALH and Port. Containerization should be standardized to allow quick and efficient transfer among modes and handling by automated equipment at the ALH and other intermodal sites.

It is during this stage that the Central Cargo Facility, inland container yard, and intermodal rail/truck facility should also be developed. Other infrastructure to be implemented during Stage II include a cold storage/perishables center and an a state-of-the-art distance education and work training facility allowing skills transfer to industries locating at Shannon from virtually any location in the world.

Stage III

During Stage III (at least five years and possibly as much as ten years from project commencement) third party logistics providers (3PLs) will set up operations at the ALH to serve growing cargo movements to and from and through the ALH. Internal roads and utility connections must be developed or extended throughout the ALH (an automated cargo transfer system described in the ultimate ALH will not likely be justified at this stage based on its high cost). The ring road and all surface transportation links should be completed, including those to the port. Rail links will also be extended during this stage and overall Atlantic Arc regional highway systems should be improved by this time.

Stage IV

Stage IV (the full-scale ALH) will be reached when sufficient manufacturing and distribution tenants and multimodal transportation and multimodal logistics providers reach a critical convergent mass so that production and logistics becomes fully integrated. At this stage, estimated to be in the 10- to 15-year time frame, all the elements of the ultimate ALH will be put in-place, including a fully functioning central cargo facility, intermodal yard and inland container port with truck and rail connections providing off-ramp and off-site manufacturers and distributors with air freighter access.

Exhibit 4.1 illustrates the four-stage phased sequence of infrastructure and industrial development envisioned at the Shannon ALH. Each of these overlapping stages will be accompanied by cumulatively increasing and more sophisticated industrial, logistics, and cargo activity.

III. Determining Appropriate Investor Incentives

The ALH at Shannon will be designed to attract and grow industry. Therefore, incentives will play an important role. To date, the Irish government

has provided generous financial incentives through which investors in the Shannon Free Zone enjoyed numerous advantages and promotional privileges. These government incentives and advantages are declining or disappearing, however. New incentives to attract and grow industry must be pursued. The ALH 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 financial incentives in attracting goods-processing industries.

What the ALH is designed to accomplish is to provide Shannon's industrial investors with speed and agility in their supply chain management, unmatched at other locations. Key to this is customs, as industry group after industry group around the world has argued. Components of products assembled in Ireland 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. In the case of an ALH air cargo or air express environment, massive amounts of freight arrive from abroad, are broken down, sorted, or consolidated, then 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."

Because so many have concluded that the customs environment at an international airport really differentiates its speed and agility in processing cargo, I would like to elaborate a bit more on mechanisms and processes that Shannon should implement.

Customs clearance procedures at Shannon should be improved to minimize dwell time and reduce the amount of attention required by customs agents. Modernization of clearance procedures depends on improvement in communications among the shipper (manufacturer, retailer, etc), forwarder, 3PL, carrier, consignee, customs administration, and other pertinent parties, as discussed in previous chapters. Installation and extensive use of web-based, open architecture EDI at Shannon by Irish Customs must ultimately be the cornerstone of improvements in clearance procedures and in tracking of cargo within any storage, transfer, or in-transit facilities. Electronic Data Interchange (EDI) was described as a digital cargo data management system that incorporates the latest in communications and data management technology.

Improvements in customs clearance procedures for airfreight start with “pre-clearance” or “express clearance.” This refers to the clearance of shipments, or portions of shipments, before they reach the ALH. Once an aircraft is airborne, the manifest and other needed information is electronically transmitted to an ALH freight agent at Shannon. The agent reviews the data, assures that the freight is properly classified, determines the value of commodities in the shipment, and arranges for electronic payment of the tariffs on the shipment. This information would then be given to Irish Customs for “profiling.”

Profiling is a procedure which checks the data for compliance with regulations, verifies payment of applicable tariffs, and determines which portions (if any) of the shipment or document are suspect and need to be inspected. Assuming the data and payments are consistent with their requirements, Customs “pre-clears” all or portions of the shipment while the

aircraft is still in the air and identifies which portions of the shipment will require inspection. When the aircraft lands, the cleared portions of the shipment go directly from the aircraft to the freight agent or 3PL for delivery to the customer and the remaining portions of the shipment are set aside for customs inspection.

Implementation of pre-clearance will require:

- Extensive coordination and communication among all parties involved;
- Published and easily understood guidelines identifying the format, content, and procedures for completing required pre-clearance documentation;
- A clear and concise system for classifying cargo shipments and the contents of the shipment;
- An acceptable way to establish or calculate the value of each item in the shipment; and,
- A published and accepted tariff for all categories in the shipment.

Efficient operations at the Shannon ALH will require electronic forms of the above capabilities. Proposed electronic clearance processes for the ALH are shown in Exhibit 4.2. The open interface for cargo management for in-transit bonded shipments at the ALH is illustrated in Exhibit 4.3 for on-site shippers, and in Exhibit 4.4 for off-site shippers. (These exhibits are adapted from the work of Global TransPark Consultants in Thailand in association with Dr. John D. Kasarda.)

An additional advantage of EDI for rapid customs clearance is its use in cargo profiling and tariff classification. EDI allows easy access to the records of

product value and classification and should, thereby, speed these checking procedures. The EDI system will, moreover, be able to: (1) automatically categorize most regular shipments into tariff categories; (2) search records for previously assessed values and then; (3) indicate whether the declared value of the shipment in question is close to that typical of previous imports. If there is a difference a warning can be issued to the Irish Customs Officer, who might then deem it appropriate to make further investigations. Most shipments would, however, be processed automatically and without recourse to further investigation or, indeed, inspection. This cargo “profiling” is akin to the procedures now common at most international airports for stopping suspect passengers, and which is based on analyses of passenger characteristics and behavior.

Apropos the above, Federal Express which operates its Asia Pacific hub at Subic Bay Freeport probably has the most advanced and demanding requirements for customs procedures. Before investing in the facilities needed for its Subic hub, Federal Express required assurances of customs procedures that were compatible with their time-based needs. To operate efficiently, they required rapid clearance of packages destined to the Philippines and freedom from routine customs inspections or charges for in-transit shipments (shipments being reshipped to destinations outside the Philippines).

A detailed memorandum of understanding (MOU) specifying the requirements of both parties was negotiated and executed by the Philippines Bureau of Customs, Subic Bay Freeport, and Federal Express. This MOU is formally called a Customs Memorandum Order.

The agreement negotiated between Federal Express, the Subic Bay Freeport, and the Bureau of Customs contained a provision requiring that Federal Express and the independent developer of its facilities be reimbursed for their investment in facilities if the Bureau of Customs did not adhere to

procedures in the Customs Memorandum Order. It is important that Shannon Development help negotiate similar agreements with Irish Customs as incentives to potential air express company locators at Shannon ALH.

IV. Irish Government Incentives

Apropos the above, in guidelines for Shannon ALH Business Plan, I proposed that Shannon Development and Shannon International Airport should immediately begin recruiting air express and air cargo firms. Along with existing or specially designed promotional privileges and express customs clearance and preclearance, the Irish government should guarantee open skies policy for air cargo. If the Shannon ALH is to attract multiple air express and air cargo service providers it must be able to offer the incentive of open skies policy for all-freight carriers, including fifth, sixth, and seventh freedom rights defined in the glossary at the end of this report. The message must be articulately conveyed to Irish government officials that a liberal open-skies policy poses virtually no threat to Shannon's passenger business and would provide the Shannon region with "International Highways in the Sky" at virtually no additional infrastructure cost.

Two other government incentives should be provided to attract air freight service providers. These are change of gauge rights (already noted) and co-terminal rights. Unlimited change of gauge rights will permit aircraft of any size to fly into Shannon and for cargo to continue its journey on smaller aircraft of the same company. 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 type operations that the ALH would be ideally suited to serve.

Unlimited co-terminal rights would permit carriers to stop at any point in Ireland to drop off shipments which originated outside Ireland or to pick-up shipments for points outside Ireland. In order to maximize payload and in order to effectively operate an agile logistics hub, it is important that foreign carriers be given such rights without restriction. This will ensure the carriers have the flexibility needed to operate out of alternative airports were Shannon ever to be closed for weather or other reasons. This is an important incentive, given the time-definite services offered by the integrated air express carriers.

Finally, it is recommended that Shannon provide the incentive of substantially reduced landing fees for air cargo carriers. Air freight is a highly cost-competitive industry and such an incentive (at least for a fixed period such as the initial ten years) could be a differentiating inducement for an air express or major air cargo firm to select Shannon as a hub. This fee-reduction incentive would be a wise investment. Once substantial air express service is provided at Shannon, it operates as a magnet for time-sensitive industries, as numerous prior experiences have shown. As just one example, FedEx has transformed the once-sleepy Memphis into a center of international business, attracting billions of dollars in investment in manufacturing and distribution facilities in the vicinity of its airport. More than 200 foreign-owned firms from 22 countries employing over 20,000 workers have been drawn to Memphis since the 1980s. U.S. companies such as Nike, Apple Computer, SquareD, Disney Stores, and Starter Corporation, among many others, have similarly established new manufacturing and distribution centers near Memphis International airport. Nearly all these companies pointed to the FedEx hub as a key attraction.

Similar patterns of industrial attraction hold where other air express and air cargo hubs have formed around the world. The message is clear, landing an international air express service provider is a powerful magnet in its own right that will draw many modern high value industries to the vicinity. Every

incentive should be pursued by public sector agencies responsible for Shannon Airport to attract such a service provider.

V. Coordination and Harmonization with Similar Facilities Elsewhere

If parts, components, and finished goods are to flow rapidly and seamlessly between Shannon and other transportation facilities within Ireland and between Shannon and facilities abroad it is essential that their information technologies and materials handling systems be harmonized. This requires using standardized EDI messages with compatible or open architecture software systems, as described in the prior chapter.

Containerization, as also noted, must also be standardized across shipping modes so that containers arriving by vessel at River Shannon Port can be transferred efficiently to truck or rail and be moved to the inland container yard at the ALH. Since some of these containers may also be air freighted via heavy-lift aircraft from Shannon, they must also be made compatible with materials handling equipment for loading on all-cargo aircraft. Multimodal materials handling harmonization will require close coordination between the Shannon 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 Europe and, indeed, the world. It would be a terribly expensive mistake not coordinate design of facilities at the Shannon ALH with the predominant technologies, materials handling equipment and space utilization standards at major ports and airports which will serve as Shannon's trading partners.

In terms of recruiting major air cargo service providers to Shannon, it is recommended that public sector agencies such as Shannon Development (or the

Shannon International Airport Authority) work with 3PLs and visit major air cargo hubs at Memphis, Louisville, Ontario, Cincinnati, Hong Kong, Singapore, Frankfurt, Amsterdam, London, and Paris to examine state-of-the-art systems being put in operation there. Though Shannon will not have the volume and scale of these major air cargo centers, 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.

It should also be noted that air express companies like FedEx have their own facility design firms. Contact should be made with these companies and advice received before any facility development contracts are signed. As a special incentive to a prospective air express or air cargo firm locating at the ALH, public sector agencies in the Shannon region may wish to offer to build a cargo facility to suit with a long-term lease-back contract. The key point is that the extent to which Shannon's cargo processing facilities are designed to be harmonized with potential user facilities elsewhere, the chances of attracting these users are increased substantially.

VI. Institutional and Management Plan for Shannon ALH Development and Operation

Considerable thought and work has been done to date on appropriate institutional and management plans for developing and operating an agile logistics hub. Most pertinent is work done for planning the Global TransPark (GTP) in North Carolina and the GTP in Thailand. In both cases, it was recommended that a special Authority be established to develop, market, and operate the GTP. For the Shannon ALH, such an organization should be chaired by the senior executive likely to be recruited from among Shannon or greater Atlantic Arc regional public and private-sector leaders. This organization would be autonomous and have authority to control and coordinate all planning,

infrastructure development and facility construction to ensure timely completion of the project. If Shannon International Airport receives full autonomy from Aer Rianta, its officers and board members should be involved in ALH Authority leadership and management, as well. Should Aer Rianta not break up, its representative would, in all practicality, need to be brought into the ALH Authority.

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

- A single organization such as an ALH Authority 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, construction contractors, tenants, users and suppliers to the Shannon ALH.
- The development of the project could be constructed in a series of phases which reflect market demands with limited multiple organizational conflicts.
- The organization would closely coordinate with all public agencies on work accomplished to date.
- The creation and hiring of staff and management positions can be flexible according to need, recognizing that some political clout will be necessary to accomplish all Authority objectives.

The disadvantages of this option include the following:

- Special enabling legislation may be required to set up the new organization could take some time.

- The new organization might be staffed by recruiting qualified personnel away from other agencies; this might not be favorable to other agencies because they could lose qualified staff or the staff might be reluctant to leave their existing assignments.
- There is no element of privatization, other than some private-sector representatives.

Option 2: Private Enterprise Builds, Operates then Transfers the ALH to Shannon Development or Shannon International Airport

A private enterprise could build and temporarily operate the Shannon ALH then, in accordance with an agreement with appropriate public sector agencies maintain concessions but transfer ownership of the ALH back to these public bodies. This option would eliminate the local public sector requirement to undertake the initial construction with its own resources. The public sector agency 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 agile logistics hub 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 government for a period of time before transferring the ALH back to a local or regional public sector agency.

With Option 2, onsite construction would be performed by the private sector and offsite infrastructure (i.e., highways, electricity lines) and utilities (i.e., water lines, telecommunications services) would be provided by the appropriate government agencies in a timely manner. This may require a mandate from the government to related agencies 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.
- This approach meets the current Irish government policy which is encouraging privatization.
- The timing of the development of the project could be accelerated to meet market demand.
- No legislation would be needed and 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:

- 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.
- The appropriate government agencies 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. An appropriate public sector agency 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.
- This approach supports government policy toward privatization.
- No special legislation would be needed and no new organizational 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 public agencies such as Shannon Development would be employed in the design and construction phase.
- These agencies would have only limited responsibilities for marketing or operating the ALH.

The disadvantages of Option 3 include the following:

- Extensive up-front public resources would have to be allocated to the project.

- An appropriate public agency would have to be organized and prepared to coordinate and manage the planning, design and construction of the ALH.
- 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.

Getting the ALH Started

To move the entire project forward a Shannon ALH Authority should be formed. Such Authority may be transitional, existing only as long as it takes to plan, construct and open the ALH. Once this phase is completed, a private sector ALH Management Company may be appointed, operating on a concessionary basis.

In terms of responsibilities, the Shannon ALH Authority would do the following:

- Supervise all feasibility analyses deemed appropriate.
- Promptly prepare and issue Terms of Reference, necessary for Shannon ALH design.
- Draft bid and tender documents for the design.

- Market the procurement opportunities.
- Select the Shannon ALH design consultant.
- Negotiate and award a contract to the consultant.
- Initiate dialogue with potential private sector users of the Shannon ALH.
- Create and approve the arrangements for private and public sector participation predicated on the development and management options selected.
- Tender the proposals for Shannon ALH development and operation.
- Select a successful tenderer.
- Prepare finalist contracts and concessionary arrangements.
- Coordinate closely with all Shannon regional and greater Atlantic Arc government and business leaders to insure that all the above are consistent with infrastructure and facility harmonization and with development planning for Shannon and the greater Atlantic Arc region.

The final responsibility is absolutely essential and should be a defining feature of all other noted tasks. For this reason, it may be wise to have the Shannon ALH Authority be made up of Shannon and Atlantic Arc regional public officials along with regional private sector leaders.

As the primary initiating organization, this body must be carefully selected not only to properly determine the best public, private or public-private venture structure to build, operate, and manage the Shannon ALH but also to create effective logistical synergies throughout the Atlantic Arc region.

VII. Summary Recommendations and Action Steps

Shannon International Airport, the Shannon Region and the greater Atlantic Arc have numerous assets and comparative advantages. These assets, including moderate costs, a well-educated work force, English language skills, strategic location in the American – European air transport nexus, and a set of visionary knowledge-oriented business development policies all contributed to its “Celtic Tiger” regional growth in the 1990s. But that is history. The world has dramatically changed and powerful new competitive players have emerged challenging not only the region’s more traditional manufacturing base but also its high-tech assets, as well. Below I present a set of recommendations and action steps for Shannon and the Atlantic Arc region to meet the business challenges of the 21st century and recapture regional competitive advantage.

1. It will be increasingly difficult for Shannon and the greater Atlantic Arc region to compete for new industry and quality job growth in the future on cost and traditional government incentives. Competitive advantage will come through strategic foci on knowledge, connectivity, speed, and agility. Shannon Development has successfully catalyzed partnerships among academia, government, and industry to develop intellectual capital and a knowledge-based business infrastructure in the Shannon region. Additional public-private partnerships need to be formed at Shannon and throughout the broader Atlantic Arc region to create a 21st century logistics infrastructure offering Irish and multinational firms superior accessibility and the fastest and most efficient supply chain management opportunities in Europe. Connectivity, speed, and agility should therefore become the region’s new competitive weapons.
2. Competitive advantage fostering connectivity, speed and agility requires a new economic engine. The engine proposed is an agile logistics hub (ALH) at Shannon International Airport that will cornerstone and drive an

Atlantic Arc logistics network. The agile logistics hub should integrate air, highway, rail, and sea transportation modes with advanced telecommunications, sophisticated materials handling systems, and state-of-the-art support services to provide tenants and users unmatched capability to respond rapidly and flexibly to changing markets worldwide. Upgraded regional highways and new and extended rail lines (including those to Western and Southern Irish sea ports) are required to integrate the ALH with Atlantic Arc cities, regional business clusters, and other regional transport modes. Similarly, state-of-the-art broadband, fiber optics, 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).

3. Just as today's most successful business are innovative, flexible, and rapidly responsive, so too must infrastructure and facility planning and design at the Shannon Agile Logistics Hub (ALH). The ALH 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 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 impact of congestion or accidents both within the ALH and connecting transport systems. ALH 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.
4. The ALH’s intermodal transportation infrastructure should 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 ALH, such as Shannon Free Zone East. A cargo transfer system must be planned linking the multi-use Central Cargo Facility (CCF) to cargo related tenants as well as to the intermodal rail facility. The CCF would provide off-ramp tenants and off-site production facilities, warehouses, and distribution centers with automated sorting capability, customs clearance, and air freighter access. At full development, the entire ALH should be served by a ring road encircling it, providing efficient access to all parts of the complex to local and regional highway systems and to the intermodal rail facility. Internal roads should likewise connect the Central Cargo Area and ALH tenants and users to the ring road.
 5. The Shannon ALH must be planned as much more than a multimodal logistics infrastructure. Its full potential and ultimate success rest on creating a total business environment that will substantially improve sourcing, production, and distribution activities of its tenants and users. This includes an automated customs environment operating 24/7 with open architecture electronic data interchange (EDI) capability, and an on-site distance education and worker training facility, one-stop-shop investment support, and the full complement of high quality, reliable utilities.
 6. Mechanization of materials handling should be targeted, incremental and implemented only as cargo demand warrants. ALH facility design should assume that in early phases much material handling would

continue to be performed with relatively low-tech materials handling equipment (e.g., forklifts, motorized tags, pallet jacks). As cargo demand grows over time, periodic evaluation of costs and benefits of automated equipment and facilities can be conducted and enhancements implemented as cost/benefit analysis justifies. Stated simply, you do not need all the bells and whistles in the earliest ALH phases.

7. Planning for the ALH should give high priority to aesthetics and quality of life. Shannon International Airport must support not only logistics activities but also regional recreation activities and tourism, along with business travel. Logistics, manufacturing, trucking, and cargo handling, in general, must be physically separated from flows of business and leisure travelers, to the extent possible. High quality design standards should be maintained at and surrounding the ALH for buildings, landscaping, and site improvement. Entrance ways and signage should be aesthetically pleasing. Since first impressions are often enduring, physical appearance is extremely important. Therefore, to the extent possible, the ALH and immediate surrounding areas should be designed to look more like a university campus or research park than a traditional industrial or logistics park.
8. Apropos the above, the long-term asset of Shannon, the Shannon Free Zone, adjacent to the airport, is getting a little tired looking. Aging buildings, cluttering equipment alongside some, limited landscaping, and an obsolete overall appearance are not what today's high-tech industries and knowledge workers are looking for. The Zone's aesthetics need to be improved including entrance signage and landscaping, building modernization (where feasible) and perhaps lighting. Fortunately, there is ample nearby land for new development close to the airport which should have a contemporary appearance, be greener, more spacious and campus-

- like, providing both outdoor and indoor recreational amenities for workers. These factors have been shown to be instrumental to attracting new economy industries and their employees.
9. Every effort must be made to attract additional passenger and air cargo service to Shannon, including direct flights to Asia (the world's fastest growing market) as well as attracting newer low-cost carriers. 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 to 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. This understanding requires a paradigm shift in thinking leading to innovative approaches to attracting additional air service to and from Shannon International Airport.
 10. The Shannon International Airport Authority should develop incentives to draw additional low-cost passenger service to the airport. There is little doubt that low-cost carriers will take on much greater shares of the aviation market in Europe, as they have already done in the U.S. And, as stated above, air routes are critical components of a region's transportation infrastructure, serving and benefiting a wide range of businesses and travelers. Working within EU policy, Shannon Airport executives, Shannon Development, and local governments and businesses should partner to generate the market conditions that would attract additional low-cost airline service. For example, in the United States and elsewhere, local businesses and governments have worked together to guarantee a certain number of seat purchases annually on new airline service routes, while airports have reduced (or even eliminated) landing

fees for additional route service by existing air service providers and new airlines alike. This will require creativity to insure that EU policies on airline subsidies are not violated and that current Shannon International Airport service providers do not feel disadvantaged.

11. To attract passenger as well as cargo airlines, Shannon International Airport should also do every thing feasible to reduce aeronautical fees (costs to these airlines, including landing fees, gate leases, fuel, aircraft parking, etc.) Kuala Lumpur International Airport (Malaysia) has had success by promoting no landing fees for new airlines serving the airport and additional (new) flights by airlines already serving the airport. Singapore (Changi) International Airport offers subsidized fuel to airlines making this airport attractive for international stop-overs. Other “softer” approaches such as improved non-disruptive passenger and cargo handling and security measures, airport aesthetics, and Shannon management-airline relations should be focused on as well. Any reduced airline fees and potential additional airport costs must be compensated for by increased non-aeronautical revenues for Shannon International Airport. Following *airport city* and *aerotropolis* principles, Shannon International Airport must be thought more in terms of a commercial entity. This would involve developing more revenue generating activities in the terminal ala Amsterdam Schiphol or London Heathrow (see recommendations #20 and #25 below), possibly creating a Shannon Airport Area Development Group to promote and manage on-site and airport-linked commercial real estate development, and generating other non-aeronautical revenues. Innovative revenue-generating relationships might be developed with off-site businesses and industries that would substantially benefit from expended passenger and air cargo airline service. The potential breakup of Aer Rianta, with airport management transferred to the Shannon Airport Authority or other airport agency,

could provide a unique opportunity to create such new non-aeronautical fee approaches to airport revenue generation.

12. Shannon International Airport's strategic advantage lies more in air cargo than in passengers with the airport handling 25 percent of Ireland's international air cargo vs. 10 percent of its international passengers. The Airport Authority and Atlantic Arc region government officials should mobilize and push the Irish government to allow "open skies" access to Shannon for air cargo and air express carriers from around the world. This should be complemented by change of gauge rights allowing these airlines to transfer cargo at Shannon Airport between small and large aircraft along with ground handling rights. The latter would allow airlines the freedom to self-handle cargo on-site between their aircraft and the Central Cargo Facility or their own sorting facility, or choose a third-party ground handler as well as freedom to transport cargo between Shannon International Airport and off-site companies. Open skies for cargo (including fifth, sixth, and seventh freedom rights defined in the glossary of this report) and other freedoms noted above should immediately attract air cargo and air express carriers. Just as Shannon led the world with launching its highly successful Free Zone so to Shannon should take the European lead and be the first airport offering the air cargo and air express industry full open skies and associated freedoms. This past year Thailand agreed to be the first Asian country to offer total open skies for air freighters while keeping traditional restrictions on passenger aircraft and combi's (half passenger, half freight) to protect Thai International Airways, its flag carrier.
13. The Shannon region will continue to face intense competition from lower-cost Eastern Europe and many parts of Asia, especially China. Rather than fighting this competition directly, a task force should be established

to explore how Shannon regional businesses and industry can partner or align with potential competitors in these regions for mutual benefit. As the United States is discovering, not only are traditional manufacturing jobs being drawn to these emerging global arenas, but increasing numbers of R&D, computer software, and white-collar service jobs are now being “outsourced” there. The giant 21st century generator of both business and tourists will be Asia, in general, and China, in particular. The task force should explore strategies for Shannon businesses to tap this huge and growing market. A necessary first condition is improved aviation accessibility to Asia which should be a high strategic priority. This could involve adding non-stop flights from Shannon Airport by Aer Lingus, non-stop service by an Asian carrier such as Cathay Pacific or “fifth freedom” connecting service by a major American carrier to Asia. To date, no American airline has a European gateway linkage to Asia, which from the eastern half of the U.S. is often faster than going over the Pacific, given tail winds. Just as Shannon International Airport served as a refueling gateway for U.S.-European airline travel in the 1960s, so Shannon International Airport might serve as a stopover for U.S. airlines wishing one-stop route access to Asia via Europe. This would require a new bilateral aviation agreement, which could balance the potential downside of the likely “open skies” agreement with the U.S. being pushed by the EU and Aer Lingus.

14. To quickly and effectively link the region to its most promising markets worldwide, the Shannon International Airport Authority should make a renewed all out effort to secure an integrated air express carrier (e.g., FedEx, UPS, DHL) to set up a regional hub or mini-hub at Shannon. The majority of growth of international air cargo is expected to be express cargo and such service would provide the region’s time-sensitive goods providing industries with a marked speed advantage. A concurrent

strategy recommended would be to get major air express carriers to provide non-stop service from Shannon to their primary American and Asian hubs for rapid one-stop distribution virtually anywhere in these important global markets. Non-stop service might include Memphis (FedEx), Louisville (UPS), Cincinnati (DHL) for the U.S., Subic Bay (FedEx), Taipei (UPS), and Hong Kong (DHL) for Asia, and Miami (all three integrators) for Latin and South America. Air express links to European air express hubs (e.g., FedEx at CDG) should likewise be pursued.

15. Marketing of the Shannon ALH should emphasize the importance of its logistics-based capabilities in attracting export-oriented businesses. Such businesses will certainly continue to seek traditional investment incentives and promotional privileges 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 realities of the 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 complex.
16. Attracting manufacturing, assemblers, and distribution industries will also require a thorough understanding of modern supply chain management principles and the order-to-delivery process. To offer a truly

marketable competitive advantage, the Shannon Airport Authority with the assistance of Shannon Development should bring together experts in logistics and supply chain management, multimodal infrastructure development and information technology to help design specifications that would properly integrate and leverage all ALH elements. Few locations in Europe or elsewhere are doing this, so the Shannon ALH can have a first-mover advantage in attracting high tech and other high value adding industries if it takes the lead in seizing this opportunity.

17. Shannon Development and the Airport Authority should establish a close working relationship with major corporate relocation and site selection consultants, making them aware of the ALH's and region's assets and regularly updating them on development progress. In most cases, multinational 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 often work closely with corporations in their site selection. By taking an indirect marketing approach via major site selection consulting firms and large corporate commercial real estate firms, a far broader range of likely potential tenants can be reached.
18. It is recommended that a good part of the initial marketing focus on attracting "big name" or "trophy" logistics service provider as Shannon ALH tenants. Once a couple of these are landed, it sends out a market signal to other 3PLs and freight forwarders that the ALH is a choice location. Since smaller fish tend to like big fish as neighbors, landing a big fish will be a significant long-term marketing advantage for the ALH in its own right.

19. Because entry appearance, project architecture and other symbols also send an important message, all Shannon ALH gateway entrances should receive special emphasis in design and image appearance. These entries must set the tone for the development within which the ALH'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 image in a futuristic, but non-gaudy manner. Design standards need to be incorporated into surrounding local communities' plans as well as the ALH's site design standards. This "image-making" or branding is a pivotal marketing strategy.
20. There are lessons to be learned by Shannon from commercial development approaches around airports 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. 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. It is recommended that public sector agencies responsible for Shannon Airport and the Shannon region take a close look at this model.
21. Whereas creating such an inter-jurisdictional authority would be favored to coordinate and optimize airport-driven development in the Shannon 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 jurisdictional officials and planners in the Shannon 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 a Shannon 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, lead to more coordinated actions to address airport-induced problems, and realize more beneficial development outcomes.
22. It is recommended that longer-range planning emphasize eventual but smooth transition of existing inconsistent buildings and land use around Shannon International Airport to functions and land uses that better leverage overall ALH productivity and sustainable development. Where feasible, explicit regulations and/or incentives should be implemented to speed this transition process.
23. Government alone cannot accomplish Shannon ALH/ Aerotropolis development objectives. It is therefore further recommended that a close partnership be formed with the private sector, including the dedicated leadership from major businesses with a highly respected regional champion taking charge. This champion should be an individual of substantial prominence who builds collaborative public-private linkages and does not polarize. The champion, working in partnership with public agencies responsible for Shannon Airport and the Shannon region, would devote full-time energy to the effort, overseeing and driving ALH and greater Aerotropolis development, mobilizing unified support from local communities, universities, corporations, and from Dublin to bring about this sea change in Irish economic development.
24. As to the management of the Shannon ALH, serious consideration should be given to bringing in an outside organization with successful experience in airport-linked logistics development and operation. These include such

organizations as Fraport AG, Schiphol Real Estate Group, Hochtief AirPort GmbH, and Alterra which is a partnership of the Bechtel Corporation and Singapore Changi Airport. For example, Fraport AG and the Schiphol Group formed a joint venture to develop the primary logistics park at Hong Kong International Airport. Such companies and strategic alliances have global reach which could also be instrumental in helping Shannon develop partners and allies in Eastern Europe and the Far East.

25. The lingering effects of September 11 and the foot and mouth crisis have negatively impacted foreign tourism to the region. Proactive response by Shannon Development and other regional public sector agencies effectively limited the damage. However, a major increase in tourism requires a new development strategy. A number of years ago, the executives of Shannon Development explored casino and gaming models elsewhere in Europe to see if a gaming strategy might be appropriate to attract a new level of tourism. For a variety of legitimate reasons, this initiative was shelved. It may be time to revisit and revise the strategy with a new approach and safeguards against problems that precluded its pursuit previously. This could take two different approaches. The first would be to limit gambling to individuals with foreign passports or to set up gaming activities on the airside of the airport (past security and immigration). The second would be to treat a casino as a part of an overall more upscale resort that would be part of a larger “themed” complex that would project the history and contemporary culture of Ireland and the region. Safeguards could be built in here, as well, to limit potential negative side effects.
26. Related to the above, a number of airports are beginning to utilize local photos, local architectural and design enhancements, and electronic art to

provide arriving international passengers with a positive introduction to the history, culture, and assets of its surrounding region. As noted above, passing through the airport is often the first impression that foreign tourists, business people, and other visitors have of a region. It could pay off handsomely for Shannon Development and other public agencies to work closely with the airport administration to provide such thematic branding to new arrivals and improve overall airport aesthetics.

27. Along with Shannon International Airport, the University of Limerick offers a powerful asset to drive “new economy” development and recruit knowledge workers and knowledge-based industries to the Shannon region. The University is quickly establishing itself as world-class by attracting internationally recognized scholars and applied researchers, and it has already proven to be a magnet for knowledge-based industries. National Technology Park, located near and associated with the University of Limerick, currently hosts 80 organizations employing 4,000 professionals and support workers. Growth in both the size and quality of the University must be viewed as instrumental to attracting additional 21st century knowledge-based industries and their professional staff to the region. Shannon Development along with local government and private-sector leadership should offer all support possible to the University to help it achieve its lofty goals in global reputation and local impact. The University’s success will redound considerably to the broader region’s benefit.
28. A formal organization structure will be needed to move the Shannon ALH from concept to reality. It is therefore recommended that a special Authority be established made up of regional public and private-sector leaders. This organization would have the responsibility to initiate, control and coordinate all planning, infrastructure development and

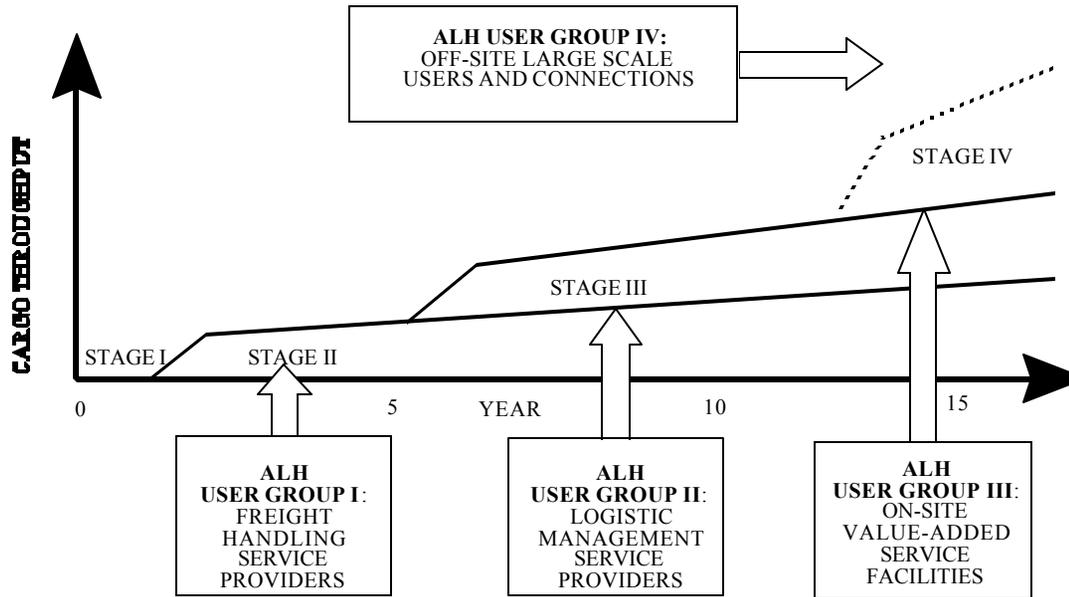
facility construction to ensure effective and timely completion of the project. The Authority would assess and determine the most efficient way to finance, build, operate, and manage the ALH in terms of public and private enterprise participation. It would prepare all Terms of Reference; draft bid and tender documents for the design; market procurement opportunities; select all consultants and monitor their work; initiate dialogue with potential private-sector tenants and users of the ALH. The Shannon ALH Authority would also coordinate clearly with all Shannon regional and greater Atlantic Arc government and business leaders on ALH development and associated logistical infrastructure development throughout the region.

29. The Shannon ALH Authority should work closely with Shannon Development and other pertinent public and private organizations as well as local governments to optimize commercial real estate development around the airport and outward from it, guiding the formation and growth of a Shannon Aerotropolis. In this regard, the Authority may wish to establish a subsidiary commercial real estate development arm operated by these participating units (similar to the Schiphol Area Development Corporation described in recommendation 20 above) to coordinate development efforts.
30. Public and private agencies responsible for development at and around Shannon International Airport may wish to take a bold step by immediately “branding” the Shannon ALH and Shannon 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 Shannon region and its competitive development future.

EXHIBIT 4.1

PHASED DEVELOPMENT AT THE SHANNON ALH

ALH USER FUNCTIONS EVOLVE WITH ALH DEVELOPMENT STAGES



STAGE I - Government provides open skies for air cargo at Shannon International Airport, change in gauge rights and revises customs procedures.

STAGE II - Air cargo carriers and airfreight services providers are attracted to ALH & expand.

STAGE III - ALH service providers evolve into total logistics management.

STAGE IV - Full ALH industrial complex in operation.

EXHIBIT 4.2

PROPOSED CLEARANCE PROCESS AT THE SHANNON ALH

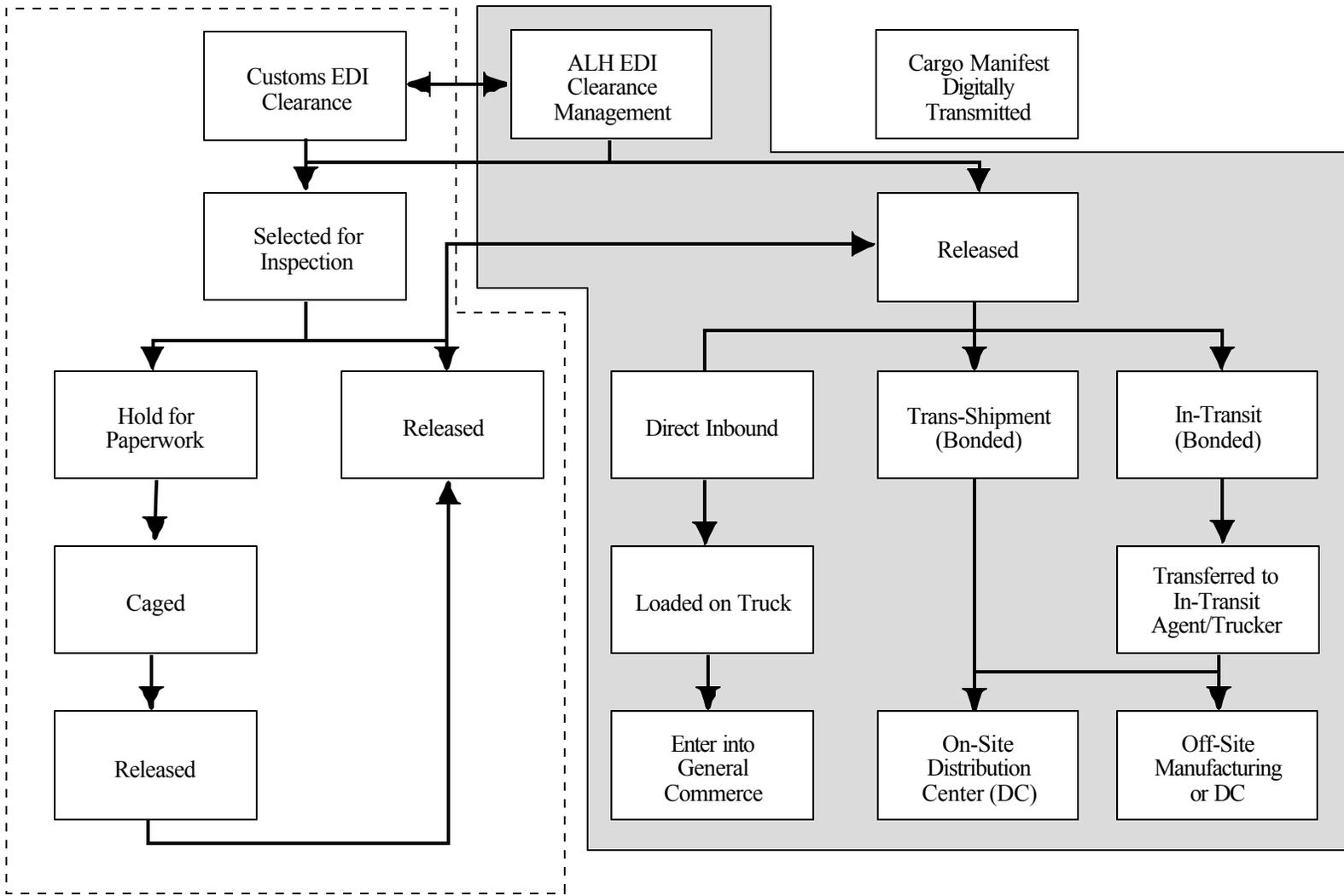


FIGURE 4.3
 PROPOSED OPEN INTERFACE CARGO MANAGEMENT AT CLARK GTP
 FOR IN-TRANSIT BONDED SHIPMENTS REMAINING ON GTP SITE

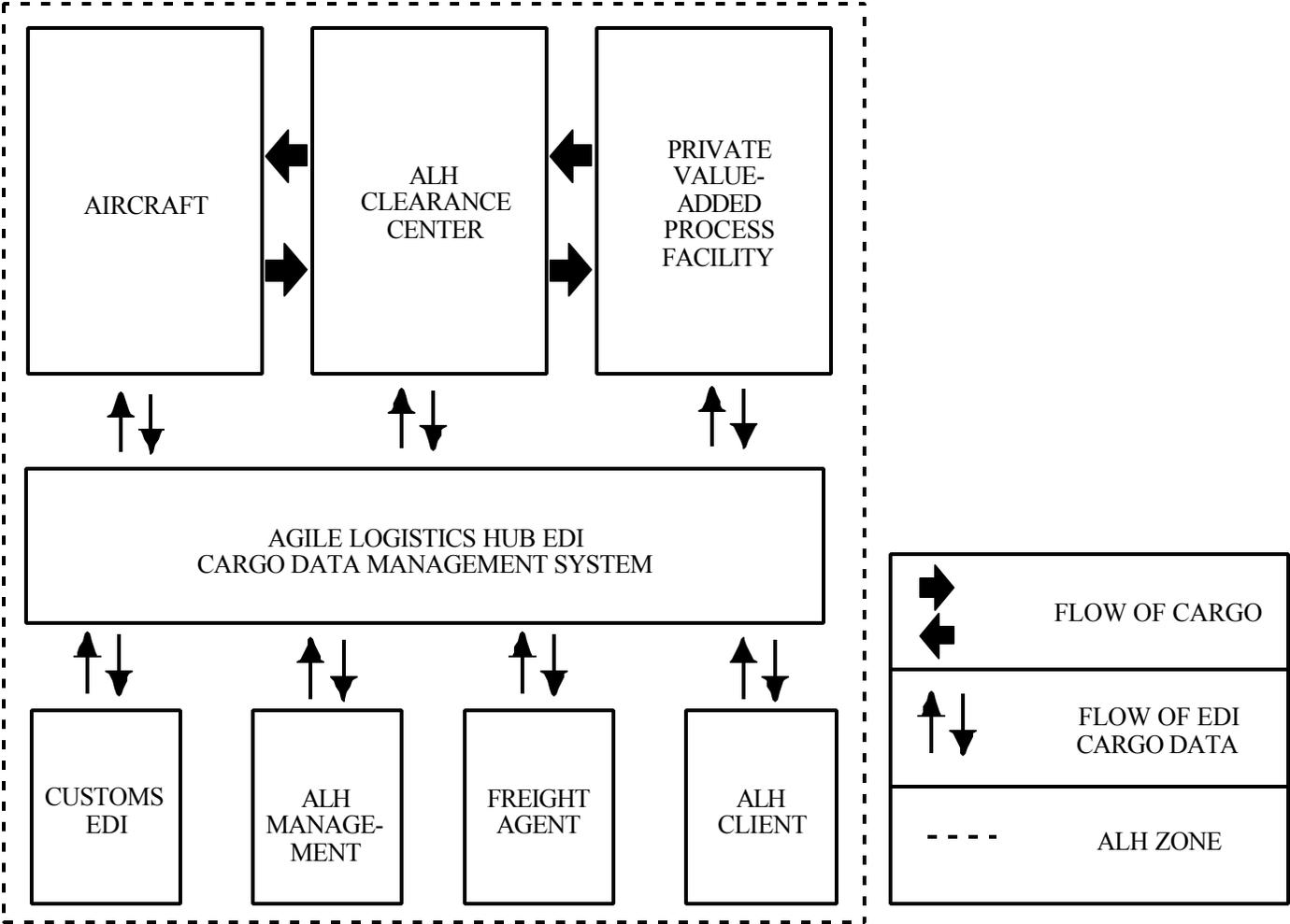
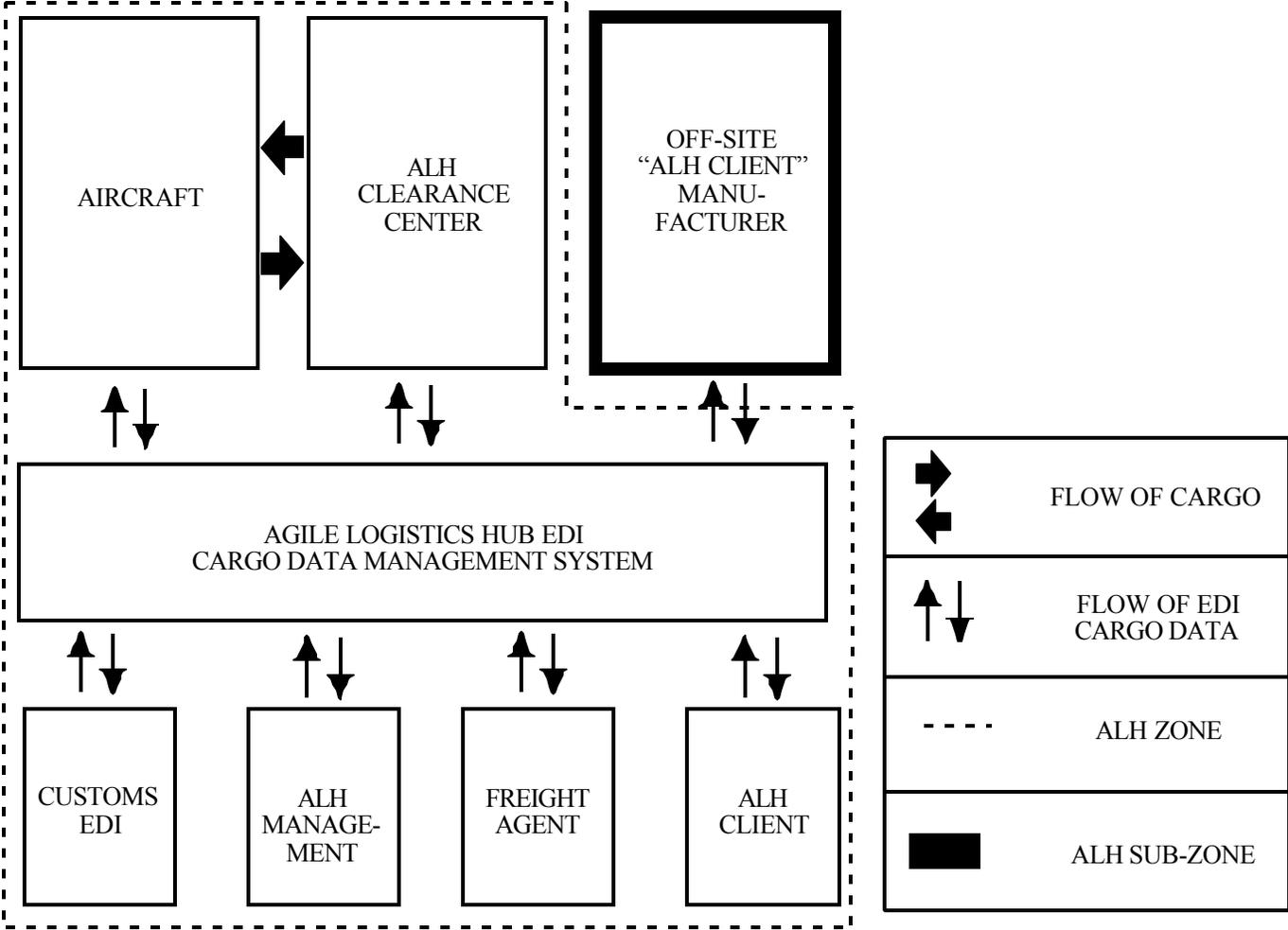


FIGURE 4.4
 PROPOSED OPEN INTERFACE CARGO MANAGEMENT AT THE SHANNON ALH
 FOR IN-TRANSIT-BONDED SHIPMENTS - ALH SUBZONE



Glossary

Aer Rianta - Dublin-based organization that currently manages Shannon International Airport as well as Dublin and Cork International Airports.

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.

Agile Logistics Hub (ALH) - A fusion of modern manufacturing and distribution facilities with multimodal transportation, advanced telecommunications, efficient materials-handling systems and commercial support services to substantially improve access and response time of tenants and users to domestic and international suppliers and customers.

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

Atlantic Are Region - A broad economic development zone in the west of Ireland from Donegal to Wexford (see Exhibit 1.1).

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

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.

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

Change of Gauge Rights - Permits an airline to fly any size of aircraft into a country and allow passengers or cargo to continue on in other size aircraft.

Co-Terminal Rights - Permits airlines to stop at any point in Ireland to drop off shipments which originate outside of Ireland or pick up shipments for points outside of Ireland.

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

Fifth Freedom Right - The right of an airline to carry passengers or cargo between two countries outside a carrier's own country of registry provided that the flight originates or terminates in that country's own country of registry.

GPS (Global Positioning Systems) - Satellite monitoring of routes and location of product movements.

Intermodal Rail Facility (IRF) - 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.

Open Skies - Refers to a number of rights (see fifth, sixth, and seventh freedom rights in this glossary) which permit airlines broad access and flexibility in flight origins and destinations.

RFID (Radio Frequency Identification) - Electronic system to trace, track, and control product movements.

Seventh Freedom Right - The right of an airline to operate entirely outside its own country of registry allowing total flexibility in routing among countries, including non-registered country hubbing rights.

Sixth Freedom Right - The right of an airline to carry passengers or cargo between two countries (neither of which are the carrier's country of registry) via the carrier's own country of registry.

Third Party Logistics Provider (3PL) - An independent organization that provides everything from basic transportation to sophisticated inventory management to manufacturers, distributors, and other shippers.

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