Global Air Cargo-Industrial Complexes as Development Tools

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COMMENTARY

Global Air Cargo-Industrial Complexes as Development Tools

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A new economic era is being spawned by three interacting forces of immense significance: (a) the globalization of business transactions, (b) a shift to just-in-time manufacturing and inventory control methods, and (c) the growing need of firms to dispatch smaller, more frequent shipments quickly to distant markets. The ability of any state or locality in the coming decades to maximize indigenous commercial growth, expand exports, and attract major investment from around the nation and the world will require understanding the new economy and harnessing the forces creating it. In North Carolina, an examination of how these forces might be leveraged to the state's competitive advantage has led to the formulation of a global air cargo-industrial complex. This proposed complex would integrate (both spatially and operationally) just-in-time manufacturing systems with air freight systems such that the two systems function as a synergistic unit. Although some of the preliminary analysis that supports the proposed complex is specific to North Carolina, the underlying concepts may prove attractive to other states interested in exploiting major changes in production processes, transportation, and global trade to generate new economic growth.

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Transportation accessibility and changes in transportation technology have always been paramount to state and local economic development. America's first great commercial centers evolved around seaports. Next came riverine and canal-linked cities that formed the backbone of America's industrial revolution. Railroads fostered the third wave of commercial development, opening up America's land-locked interior to manufacturing and trade. Major centers of goods processing and distribution emerged at rail hubs, generating massive numbers of jobs and commercial activity at these terminal and "break-in-bulk" points. For example, the contemporary South's largest commercial center, Atlanta, developed as a railway hub and was initially known as Terminus.

The fourth wave of development was spawned by highways and the shift to cars and trucks to move people and goods. With the introduction of freeways, beltways, expressways, and interstate highways, massive deconcentration of economic activity commenced. Major suburban commercial centers developed and many rural communities along the interstates that were previously inaccessible had new economic life pumped into them; those that remained isolated stagnated.

We are now entering the fifth, and perhaps most opportune, developmental era where international markets and international sourcing will play increasingly dominant roles, and speed of production and distribution will become critical competitive factors. This new era is being ushered in by three irreversible forces of immense significance: (a) the globalization of economic transactions; (b) fundamental changes in manufacturing methods from producing large, uniform batches

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This new era is being ushered in by three irreversible forces of immense significance: (a) the globalization of economic transactions; (b) fundamental changes in manufacturing methods from producing large, uniform batches to making customized goods on short notice and to "just-in-time" (JIT) processes that substantially cut production and delivery cycles to minimize inventory costs, and (c) a growing requirement of business to ship products by air rather than by surface.

to making customized goods on short notice and to "just-in-time" (JIT) processes that substantially cut production and delivery cycles to minimize inventory costs, and (c) a growing requirement of business to ship products by air rather than by surface. The combined thrust of these interacting forces is creating an entirely new economy where aviation and airports will ultimately supplant seaports, rail and highway systems as the primary job and wealth generators for states and localities.

The ability of any American region in the coming decades to maximize indigenous commercial growth, expand exports and attract major investment from around the country and the world will require understanding the new global economy and the forces creating it. Competitive success will also require vision and proaction regarding the pivotal role aviation will play.

In North Carolina, an examination of how these forces might affect the state's economy has led to formulation of concepts for a global air cargo-industrial complex which could provide a competitive edge in fostering new economic development and creating jobs. The Federal Aviation Administration has awarded the state a $350,000 grant to assess the feasibility of the complex and study is currently underway. Although some of the preliminary analysis and planning that supports the proposal is specific to North Carolina, the underlying concepts summarized forthwith may prove attractive to other states interested in exploiting changes in global trade and transportation, and thus generating new commercial growth.

MACROFORCES CREATING THE NEW ECONOMY

Globalization

Since the early 1980s there has been a marked growth and integration of world markets resulting in huge volumes of raw materials, components, and finished products flowing across international borders every day. U.S. exports and imports more than doubled during the 1980s, reaching $1.3 trillion annually by 1990, while total world trade surged to $4 trillion per year. Investment abroad by America's multinational corporations likewise mushroomed to $1.3 trillion in 1990.

The growing interdependence of world markets is reflected not only in terms of international trade and multinational corporate activities, but also in international information flows and financial transactions. For example, between 1977 and 1987, international telephone calls to and from the U.S. (the vast majority for business purposes) rose by well over 1,000%, from 300 million minutes to nearly 5 billion minutes. At the same time, Japanese, German, and Dutch banks have become the chief underwriters of U.S. Treasury bonds and financiers of massive commercial real estate projects in the United States and around the world. By 1990, the *daily* volume of foreign exchange trading exceeded $600 billion.

Perhaps nowhere is the new global economy more concretely manifested than in the dramatic rise of component sourcing. Nearly a decade ago, Ford introduced the world car, assembled in Detroit from parts produced on each of the major continents. Today, global sourcing is commonplace with advanced telecommunications and transportation technologies allowing wide geographic dispersion of component manufacturing sites and places of final assembly, depending on raw material availability, labor costs, and markets. In this regard, a personal computer produced at IBM's Research Triangle Park (North Carolina) facility is likely to be assembled from integrated circuits imported from Japan, a power supply unit from Singapore, microprocessors from Korea, disk drives from Malaysia, and a glass screen from Taiwan.

Just-in-time Production and Delivery

The shift to a global economy, although generating a phenomenal expansion of market opportunities, has also brought in a multitude of new international competitors, placing growing pressure on U.S. firms to reduce costs and increase productive efficiency. In the manufacturing arena, global sourcing has been one mechanism frequently employed to reduce costs. Another is

a major innovation in production, distribution, and inventory control methods known as just-in-time. Under this system, all elements in the value chain, from raw material acquisition to delivered finished products, are synchronized to substantially cut production and delivery cycles and virtually eliminate inventories.

The economic logic underlaying just-in-time operations is that inventory carrying costs are becoming a greater percentage of the total cost of production and distribution of many products. According to Business International Corporation, the proportion of total distribution costs that goes to maintaining inventory has doubled during the past decade, with timing of delivery a crucial factor. Early delivery raises warehousing and inventory expenses, while late delivery results in costly interruptions in production schedules and missed sales opportunities. The new economy will place a premium on manufacturers acquiring materials and producing and delivering finished products in a highly synchronized fashion, precisely as needed.

The necessary transition to just-in-time systems is also being validated by marketing research which shows that consumer tastes and product demands are changing more swiftly today than was the case in prior decades. Indications are that such shifts will accelerate faster in the decades ahead resulting in situations where products that are "hot" one month may become obsolete the next. Thus, the current era when manufacturers can produce large batches of standardized goods for relatively stable markets will inexorably give way to an accelerated era of customized production on short notice for quick response to changing demand. Just-in-time systems are ideally suited to this new economic environment where flexibility and speed will be imperative to competitive success.

The Coming Aviation Era

With international transactions, production flexibility, and speed characterizing the new economy, it is certain that air cargo will play an increasingly important role. No other means of transit is better equipped to meet the economic realities of the coming era where global sourcing and selling and just-in-time logistics will require that producers receive and ship smaller quantities more frequently and quickly over long distances. Already air freight accounts for more than one-third of the value of U.S. products exported, a percentage that will surely rise in the years ahead. International air cargo shipments are projected to grow at least 7% annually during the 1990s with the booming Pacific Rim routes generating double digit annual growth rates throughout the decade.

Most of this cargo will continue to be shipped in the bellies of passenger planes, with some Boeing 747s carrying as much as 35 tons of cargo along with their passenger loads. So important has international aviation become that the Boeing Company alone has some 2,000 aircraft on back order, including over 300 747s and 200 767s. Yet, because air cargo is growing so much faster than passenger transit, hundreds of passenger planes are being converted to all-cargo carriers, including numerous 747s. New orders for all-cargo-aircraft (known as freighters) are likewise rapidly rising with Boeing expected to sell at least 125 747-400 freighters (the largest U.S.-produced airplane with well over 100-ton cargo capacity) during the 1990s.

In prior economic eras, when speed of delivery and production flexibility were less crucial to competitive success, air freight was considered a luxury. It was confined primarily to small, lightweight, compact products with high value-to-weight or to items needed on an emergency basis at a distant site. Today, essentially anything that can be loaded onto a large aircraft is routinely shipped internationally by air—automobiles, heavy machinery, high-tech equipment, textiles, furniture, pharmaceuticals, live cattle, bulk seafood, poultry, and agricultural products. When Japan reduced its tariff on American cigarettes by 26% in May 1987, 10 million pounds of U.S.-made cigarettes were air freighted to Japan in the following 4 months. Moreover, air freight is creating entirely new industries such as shipping fresh cut flowers and other highly perishable goods for delivery to distant markets within hours.

The next generation of freighters will be similar to the world's largest aircraft, the Soviet Antonov 225 which was the darling of the 1989 Paris Air Show. This ocean vessel-size cargo plane is 290 ft long, has a wingspan of 100 yards, a landing gear consisting of 32 wheels, and it can carry a payload of 250 tons thousands of miles. Hypersonic planes are likewise on the drawing boards which will be able to carry products from the East Coast to Europe in less than 2 hours and to the Pacific Rim in less than 3 hours. The engines have already been developed and prototypes are expected to be flying by 2005.

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It is not unrealistic to suggest that within 20 years advances in aviation will place America's businesses within 3 hours delivery time to virtually any other part of the world, providing same day global access to nearly 8 billion potential consumers. State and local leaders must plan now for these and other inevitable technological advances that will usher in the "fast century" where speed, speed, and more speed will separate global business winners from losers.

Looking at the more immediate future (the 1990s), global market growth potential is also immense. Most of that growth will be in the Pacific Rim, a $4 trillion market expanding at $5 billion dollars a week. Nearly two-thirds of the world's population lives in Asia which contains the fastest growing economies, most of which are expanding at real rates two to six times that of Europe and the United States. So rapid are the increases in income levels and numbers of Asian consumers with substantial purchasing power that *Fortune* magazine produced a special fall 1990 issue solely on Asia, dubbing it "Mega-Market of the 1990s." All forecasts project U.S. trade with Asia growing much faster than with any other region of the world.

Unfortunately, the East Coast states are on the wrong side of the country to take maximum advantage of trade with the booming Pacific Rim economies. The West Coast states have substantially better geographic accessibility and significant temporal advantage because most exports and imports of East Coast businesses to and from Asia are currently shipped by truck or train across the country, delaying delivery from 4 to 7 days. Air cargo essentially levels the playing field by cutting the shipping-time disadvantage to only 3 hours, which is the time difference in landing a 747-400 freighter from Seoul or Tokyo at a New York or North Carolina airport versus a California airport. In the fast century, many East Coast companies wishing to do business in the Pacific Rim will have no other option but air freight to be competitive. The same may be said for Midwest and western states wishing to conduct business with Europe.

How valuable is an air route to the Pacific Rim? Houston officials, in their bid last fall to obtain nonstop service to Japan, had a study commissioned that showed that the route would bring in a half billion dollars a year in increased trade and tourism to the Houston area. Similar testimony is provided by other reports from around the country and scholarly research that clearly document the growing importance of international airline accessibility for state and local economic development.[1]

With air freight becoming an integral part of a new economy based on international sourcing and sales, just-in-time production and inventory systems, and speed of delivery, let me describe how these forces can be brought together in the form of a global air cargo-industrial complex that would provide regional economies with a propitious jumpstart into that fast century.

THE COMPLEX

. . . instead of having runways and air cargo facilities with land adjacent to them developed as manufacturing sites, JIT plants will actually be located along the taxiways, allowing freighters to interface with them, just as railway side-spurs allow freight trains to move alongside factories for raw material delivery and loading of finished products.

I must make clear from the start that I am not talking about an air cargo airport, but a computer-age industrial complex in which aviation will play a pivotal distributional role. The proposed complex, which substantially extends in scale and integrated systems technologies the successful Alliance Airport in Fort Worth, Texas, would bring together (both spatially and operationally) just-in-time manufacturing systems and air freight systems such that the two systems function as a synergistic unit. As shown in the accompanying illustrations, instead of having runways and air cargo facilities with land adjacent to them developed as manufacturing sites, JIT plants will actually be located along the taxiways, allowing freighters to interface with them, just

as railway side-spurs allow freight trains to move alongside factories for raw material delivery and loading of finished products. Likewise, similar to passenger terminals where passengers move from ticket counters to gates via concourses and from the concourses into the planes via connecting jetways, the JIT factories would contain computerized conveyor systems along a central movement corridor and feeder lines connecting the central movement corridor to the freighter. Freight transfer logistics would be developed so that while one feeder line is unloading components and materials from one end of the plane another line could be loading finished products at the opposite end. All factories would have rear road access for transferring products to and from trucks for local and regional distribution to customers and to existing commercial airports for domestic air freight.

There will likely be certain economies of scale for centralizing U.S. customs, security, sophisticated loading equipment, and smaller load pick-up and delivery by having central distribution terminals rather than having freighters taxi directly to each factory. The factories would be connected to the central distribution facilities via high-speed electronic transfer vehicles (ETVs). These central facilities would have areas for unit-load devices (ULDs) and storage areas (slots) for several hundred units up to and including 20-ft containers. They would interface with nose and side loading aircraft via nose docks and feeder lines. The docks would be served via ETVs operating throughout the entire industrial complex picking up and delivering cargo pallets and containers to computer-designated storage slots in a manner similar to modern computerized baggage handling as is done at our largest airports. Freight will be automatically weighed as it enters the facility and the weight and balance information prepared and destination checked for loading on each specific flight. Thus, when Cargolux Flight 276 pulls up to the nose dock for loading, the full load is automatically plucked from the stacks and slots in the proper loading sequence and loaded on the aircraft. The same procedure will work in reverse when ETVs arrive to pick up containers and pallets from the aircraft to be delivered to the JIT factories (see illustrations). Each centralized distribution facility would be designed so that numerous freighters could be loaded and unloaded simultaneously. Intermodal operations could bypass the terminal with intermodal (20-ft) containers moved directly from the aircraft to prestaged truck chassis.

In addition to the JIT manufacturing and central distribution facilities, the complex would contain critical inventory replacement warehouses with round-the-world and round-the-clock communications networks. Critical parts would be kept here for emergency shipment to international customers or dealers. Thus, a message to this center for an emergency replacement part for an advanced technology machine in Bangkok or Brasilia would be expeditiously acted on with that part immediately placed on the next available flight to that destination.

The complex would contain two 13,000-ft runways (the length necessary for giant cargo aircraft of the future and possible hypersonic freighters) and two parallel taxiways on either side of each runway. Each of the four taxiways would be anchored at their ends by two major global air cargo companies (e.g., Federal Express, Cargolux, United Parcel, Burlington Air Express) with their own aprons and maintenance facilities that they would control. As indicated, the industrial plants would be lined along either side of each two and one-half mile taxiway. This would provide approximately 10 miles of taxiway siding on which the JIT facilities could locate, generating the economies of scale to attract the air cargo company anchors. The entire complex would be tied together by a high-speed monorail passenger mover which connects the buildings, parking, public transportation and lodging facilities.

Preliminary analysis done by the University of North Carolina Business School's Center for Manufacturing Excellence shows that, were such a complex developed in North Carolina, the manufacturing facilities alone would generate a minimum of 30,000 jobs directly, with substantially greater indirect job generation through employment multipliers. At full capacity, it was estimated that the complex would contribute as much as $5 billion annually to a state's economy. This does not include the economic impact that the complex would have on manufacturing and distribution facilities located within 3 hours driving distance of the complex which could conduct a full day's production, truck it to the air cargo complex, and have it delivered via overnight freight to virtually anywhere in the world.

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Costs of providing the basic infrastructure (excluding land acquisition and construction of manufacturing, warehousing and other business facilities, the latter assumed by the companies located at the complex) are initially estimated to be in the $400 million range. Note that this is a very small portion of the projected annual economic returns that the complex would generate.

Apropos siting criteria, at least 15,000 acres would be required for the entire complex. It should be located on or very near major interstate highways within one hour's driving or high-speed commuter rail time to at least one major metropolitan labor market. Flat topography would hold down construction costs, and the complex needs to be served by the full complement of utilities.

Most flights will be at night by many large freighters. Aircraft noise restrictions and inevitable further restrictions on the number of night flights in metropolitan areas, as well as the massive amount of land needed for the entire aviation-industrial complex, point to a rural location of minimal population density but maximum highway accessibility. No tall objects should be within 10 miles of the complex and all land up to five miles from the complex should be appropriately zoned to minimize conflicting functional use. Free Trade Zone status must also be obtained for the complex.

Because the vast majority of the anticipated flights to the global air cargo-industrial complex will be international, the complex should substantially benefit existing airports that handle cargo. Many of the large loads that arrive at the complex from abroad on the freighters will, in turn, be broken down into smaller parcels and trucked to existing commercial airports where they will be placed in the bellies of passenger planes for speedy delivery to national markets.

Studies by the Federal Aviation Administration and Transportation Research Board repeatedly document that virtually all major U.S. airports will reach maximum capacity by the early 21st century. Already, our major international airports (e.g., New York's Kennedy, Chicago's O'Hare, Atlanta's Hartsfield, LAX and SFO) are overcrowded, seriously limiting their future cargo and passenger expansion prospects. Without new major airports, congestion and delays will mount to crisis proportions, given current forecasts for strong air traffic growth in the 1990s and beyond. Not only will dangerous crowding conditions emerge, and increasing numbers of passengers be seriously inconvenienced, but mounting delays will weaken the very competitiveness of America's businesses.

Thus, as planning for the global air cargo-industrial complex moves forward, consideration should be given for developing a wayport (passenger transfer airport) as a second phase at the site and a third phase development of short-time use business centers, hotels, and recreation facilities to serve in-transit passengers flowing into and out of the wayport. The wayport would also substantially increase the nation's air capacity by diverting tens of millions of transit passengers away from the most congested airports and efficiently connecting them to their final destinations. The wayport would also complement the global air cargo-industrial complex by offering cargo space for smaller loads in the bellies of passenger planes frequently flying between the wayport hub and commercial airports around the country.

CONCLUDING COMMENT

The above description only outlines the concept of a global air cargo-industrial complex. A full range of engineering, environmental, regulatory, and logistical issues specific to any proposed location would have to be addressed to make the concept a functioning reality. But plans for addressing these practical details, important as they are, must be rooted in a clear understanding of the fundamental forces shaping our economic future: the globalization of business transactions, the shift to just-in-time manufacturing and inventory control methods, and the growing need for firms to dispatch smaller, more frequent shipments quickly to distant markets. State and local leaders should explore how these forces can be harnessed and leveraged in the form of global air cargo-industrial complexes to enhance their region's economic competitiveness and achieve their development potential.

A Global Air Cargo Industrial Complex in North Carolina

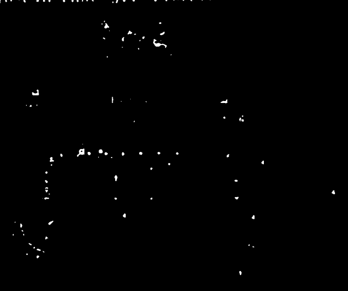
VISION

Governor *James G. Martin*

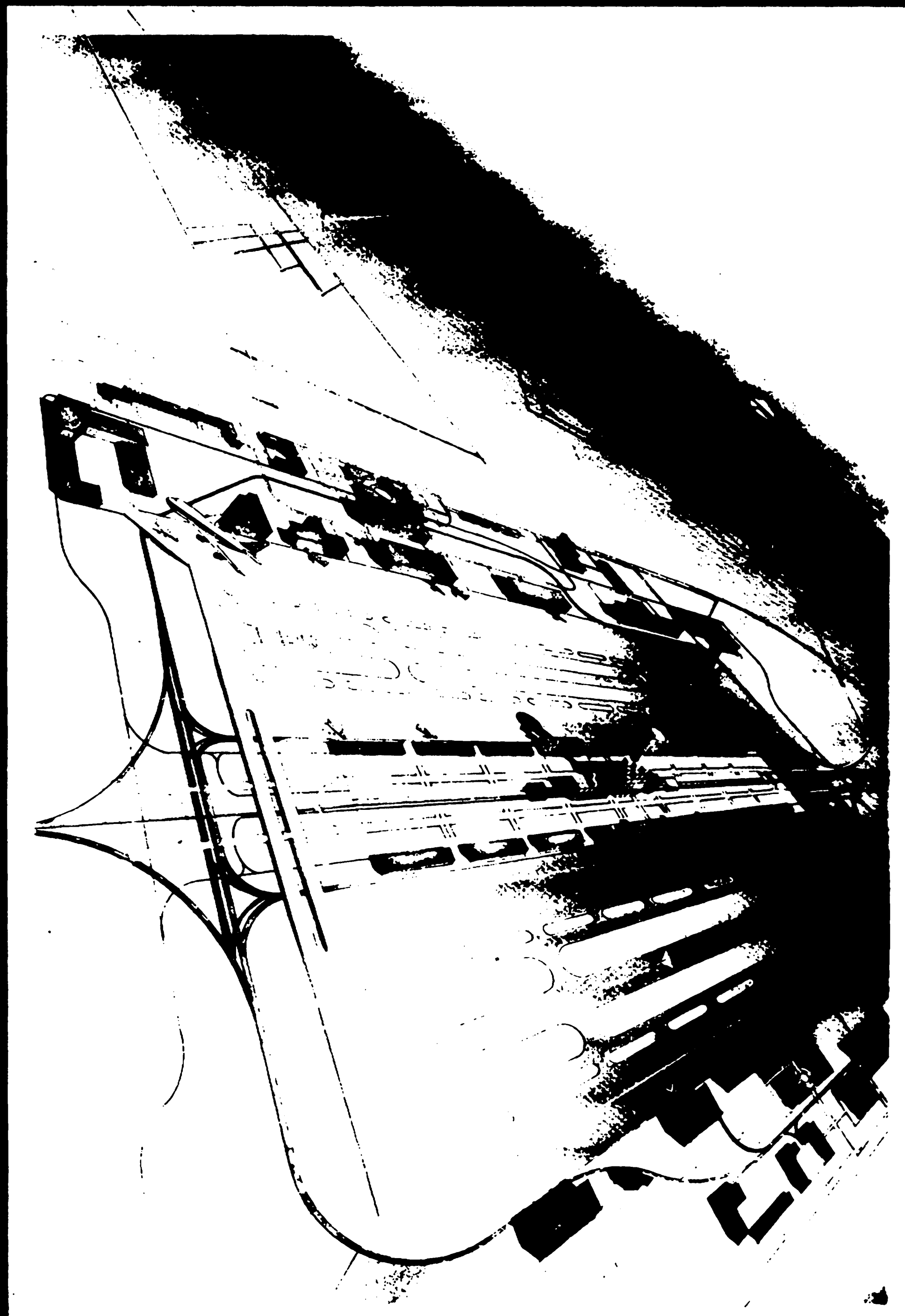
CONCEPT

Dr. John D. Kasarda

The Just-In-Time (JIT) Process

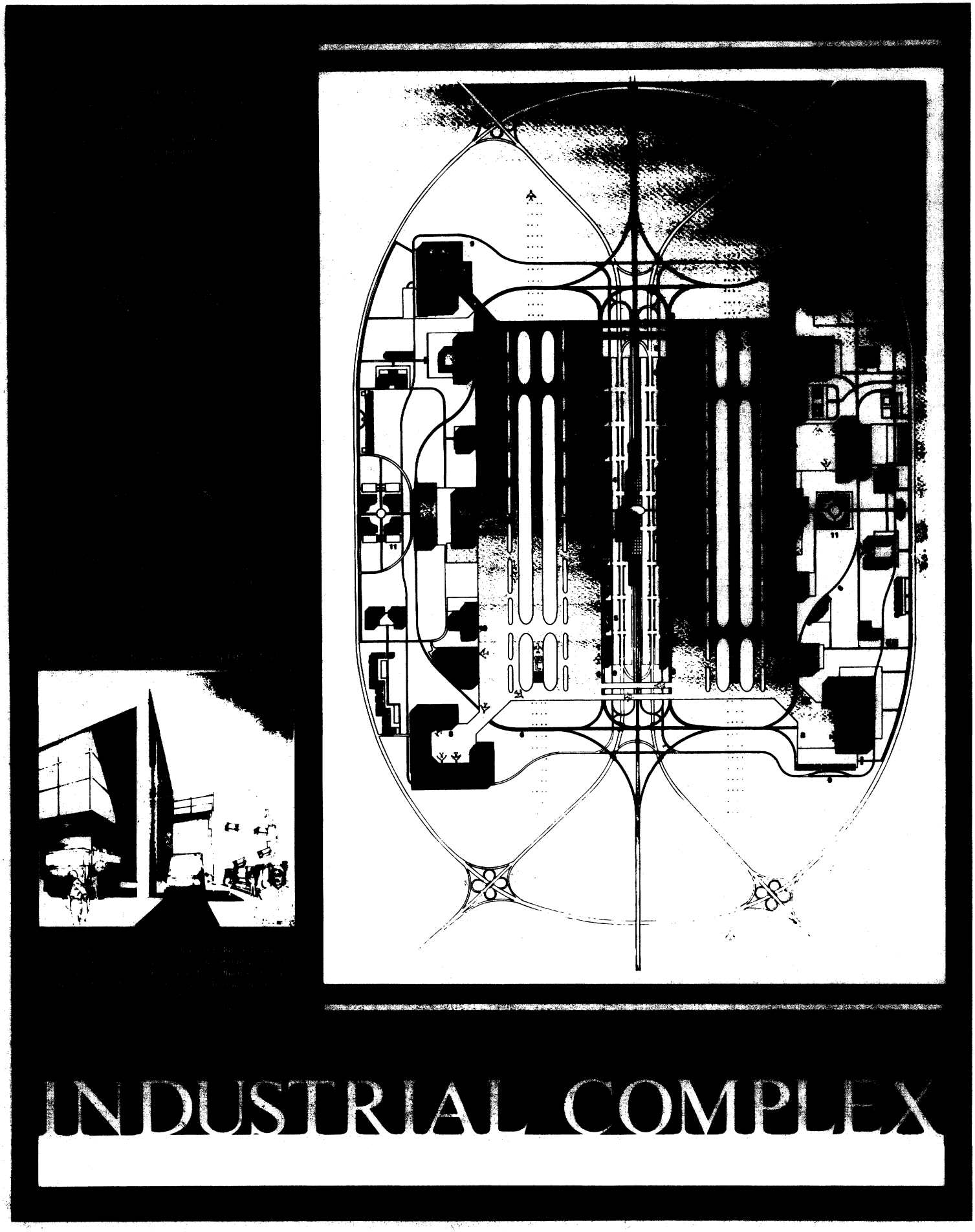


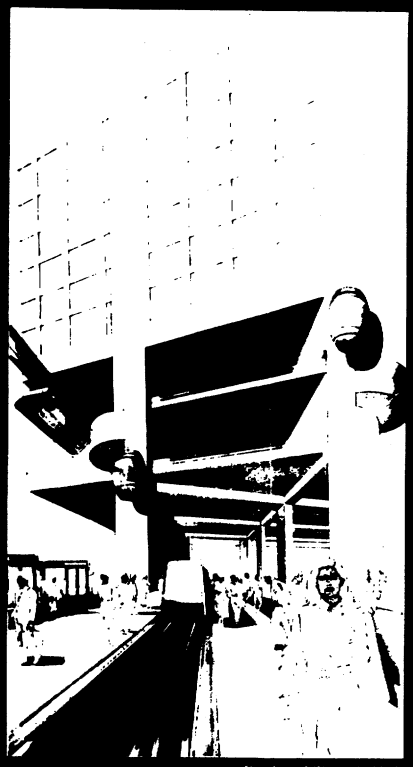
1. International customer electronically sends order to sales office at factory
2. Sales order goes to factory floor which then alerts purchasing to buy raw materials
3. Purchasing electronically sends purchase order to local and remote suppliers
4. Suppliers through air, truck, or rail deliver raw materials to start of process at factory and to staged assembly stations throughout the manufacturing process
5. Materials move rapidly through the production process
6. Finished goods are air freighted JIT to customers shortly after the order is placed



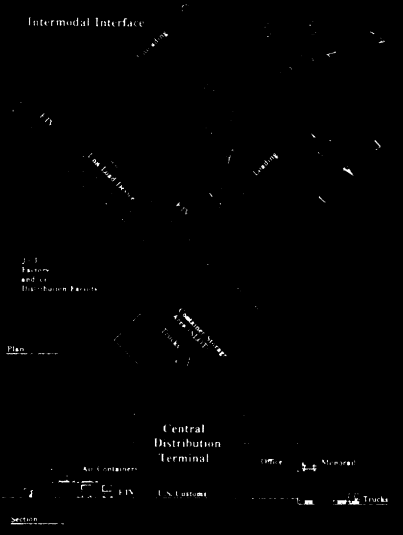
An Aerial Perspective

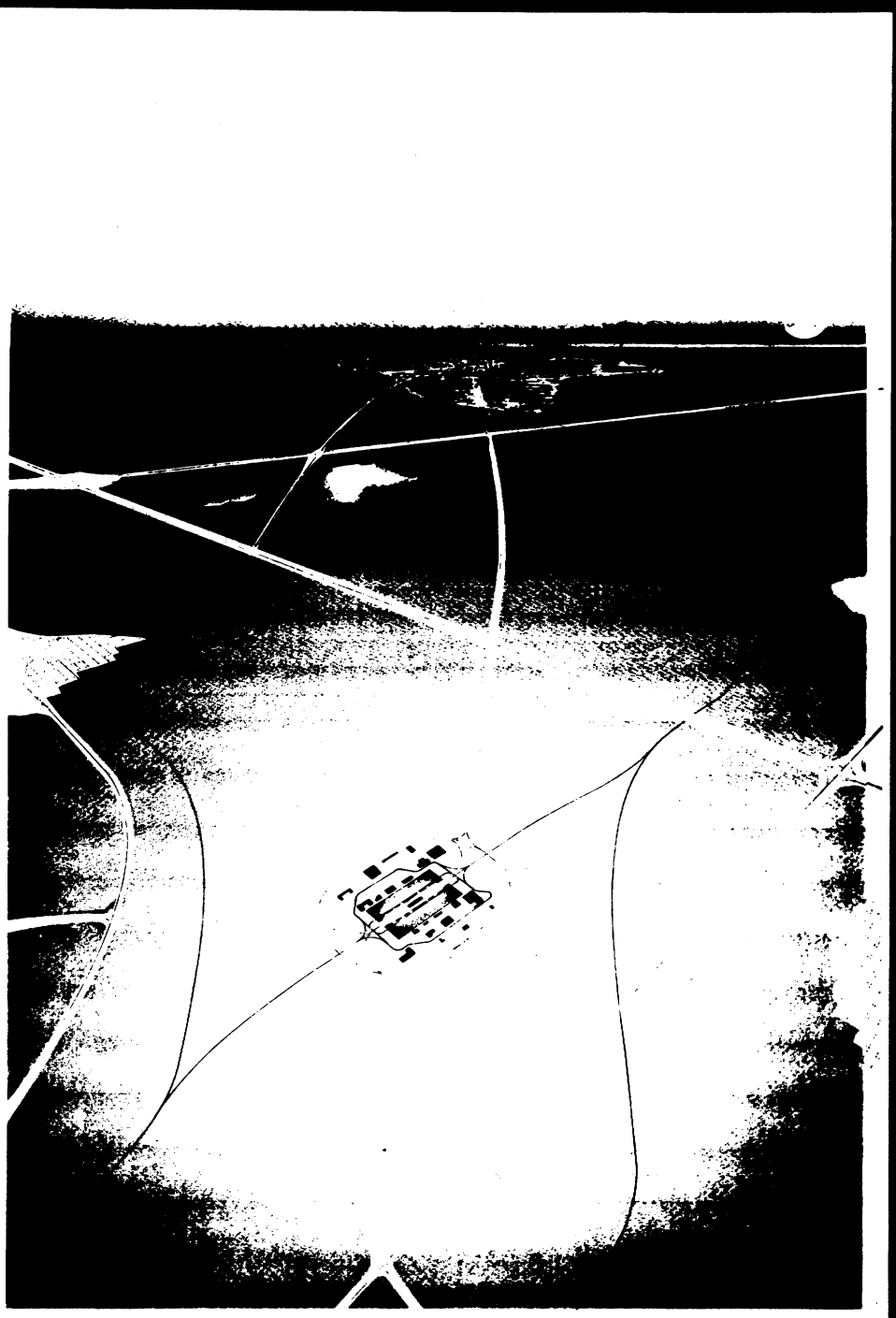
A GLOBAL AIR CARGO





Regional Transit Hub





A Regional Perspective

ILLUSTRATION

Illustrations Prepared By Envirotek Inc
Architects, Engineers, Planners.

A.J. FLETCHER FOUNDATION

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IN NORTH CAROLINA

NOTE: Illustrations prepared by Envirotek, Inc., of Raleigh, NC.

NOTE

1. Arthur L. Centonze, "Quasin Economic Locational Determinants of Large Foreign Headquarters: The Case for New York City." *Economic Development Quarterly* 3 (1989): 46-50; D. K. Massey, "Airports Spin the Wheel of Fortune," *American Demographics*, February 1988, pp. 42-61; Partnership for Improved Travel, *The Economic Impact of Civil Aviation on the U.S. Economy* (Washington, DC: Wilbur Smith Associates, 1989).