

# Express Air Cargo in the Pacific Rim: Evaluation of Prospective Hub Sites

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The rapid growth of the air cargo market is paving the way for the development of a major express airline hub in the Asia-Pacific region. Potential hub sites are evaluated using five criteria: capacity, location, local market size, terminal services, and route authority. The results illustrate that a South China hub would have immense locational advantages, saving an express carrier as much as \$10 million annually in fuel cost. Of the eight sites evaluated, a hub in Hong Kong could serve the Pacific Rim with the fewest *flight hours* of service, whereas a hub in Taipei, Taiwan, could serve the region with the fewest *tonne kilometers* of service. Hong Kong also has the most lucrative local market, which minimizes the need for cargo transfers between flights and could save a hub operator \$7 million annually in terminal costs. Airports in South China, however, currently cannot satisfy all the criteria for hub development. Terminal services remain particularly inadequate. Almost by default, Manila has emerged as the front-runner for the Pacific Rim hub—a development that could markedly affect airlines' operating efficiency and patterns of Asian trade.

The growth of the air cargo market is paving the way for the development of a major express hub in the Asia-Pacific region. Such a hub would improve significantly the reliability and speed of cargo service between Asian commercial centers. Five cities—Hong Kong, Manila, Shenzhen, Singapore, and Taipei—are leading contenders to become the dominant express hub.

This paper outlines the geographic and economic factors that will shape the development of this hub. The results show that a South China hub would have strong locational and commercial advantages over other sites. Many obstacles stand in the way of hub development in this region, however, leaving airlines little choice other than pursuing less-than-ideal locations for their hubs. This could markedly affect the efficiency of the hub operation itself as well as future patterns of Asian airborne trade.

This paper offers a background perspective on express cargo services and the global role of express hubs, outlines the economic benefits to metropolitan areas associated with the development of a local express hub, evaluates the strengths and weaknesses of eight potential hub sites, and discusses implications and conclusions.

## BACKGROUND

Express cargo airlines are carving a growing niche in the freight market by providing faster, more convenient service than traditional air cargo operators. Called "integrators" because they vertically integrate air and ground services, express cargo airlines offer shippers guaranteed overnight delivery, door-to-door convenience, and

computerized information systems—for which Asian shippers pay substantial premiums. Although express shipments account for only 5 percent of total tonnage in the region, they generate nearly 20 percent of air cargo revenues (1).

Two types of express carriers serve the Pacific Rim: *direct* carriers, which operate their own aircraft, and *indirect* carriers, which lease space on the scheduled flights of other carriers. Federal Express Airlines and United Parcel Service (UPS), both based in the United States, and TNT Express Worldwide, based in Amsterdam, The Netherlands, operate as direct carriers in the region. The region's largest indirect carrier, Hong Kong-based DHL International, transports most of its Far East cargo on passenger flights, even though DHL freighters directly serve many overseas markets. General cargo airlines, such as Cathay Pacific Airlines, Japan Air Lines, and Singapore Air Lines, also operate successful express businesses. Their services, however, tend to be relatively specialized, limiting their market share to about 5 percent (2).

## Market Growth

Express shipments are growing in volume by 20 percent annually in Asia, compared with 5 percent in North America and 9 percent in Europe (3). In the Special Economic Zones of China, the volume of express shipments is more than doubling each year (2). By 2000, shipments throughout the Pacific Rim are expected to increase 300 percent, to 10 billion T-km annually (3). (A tonne kilometer is 1 T of cargo carried a distance of 1 km.) This will make the turn-of-the-century Pacific Rim market roughly the same size as the present U.S. express market.

Asia's expanding service economy and the proliferation of just-in-time inventory systems are expected to fuel most of the market growth. These developments are creating a need for "global sourcing" services—logistics, distribution, and warehousing support for multinational companies needing fast delivery of inventory and replacement parts. Anticipating rapid growth, for example, Federal Express recently established a global sourcing facility in Singapore as part of its Partsbank program. Not to be outdone, DHL is vigorously promoting a similar program, Interchange, throughout the region.

Express carriers do not limit their business to small parcels, replacement parts, and other types of door-to-door traffic. As much as 85 percent of their Asian cargo is airport-to-airport freight (4). At Federal Express, for example, daily flights often are filled with lower-priority cargo, much of it from customers predating the carrier's 1989 acquisition of Flying Tigers. Nevertheless, with their emphasis on "time-definite" delivery (i.e., strict adherence to a predetermined delivery schedule), express carriers are able to command higher prices than general cargo carriers.

Countries throughout the region urgently need improved express services. The integrators' current system of shipping most inter-Asian cargo on passenger flights denies shippers the fast service they need for time-sensitive freight. Because of the daytime scheduling of passenger flights, some regional shippers seeking overnight delivery must drop off packages during the early morning hours of the preceding day. Between Jakarta, Indonesia, and Seoul, South Korea, for example, the deadline is 8:00 a.m. because the last direct flight between these cities departs at 11:00 a.m. In other markets, in which complex flight connections are involved, shippers have no access to overnight cargo service. Reliability also is affected by the frequent cancellations and delays associated with international passenger services.

### Expanding Role of Express Hubs

Hub systems not only enhance speed and reliability but allow carriers to consolidate freight en route to many destinations onto a single plane, enabling them to use larger, more efficient aircraft. This characteristic will be particularly important for an Asia-Pacific hub operator, which will serve airports separated by long distances. (On the basis of data presented later in this paper, the average regional flight segment will be about 2300 km, compared with 1500 km from North American hubs.) Because of the need to use large aircraft, the Asia-Pacific market is expected to be large enough to support only one major hub during the next decade. Therefore, the development of a hub is an all-or-nothing proposition for regional airport authorities.

The possibilities for a Asia-Pacific express hub are exemplified in North America, where integrators now earn more than 60 percent of air cargo revenues. Since launching the first hub-and-spoke cargo system in 1973, Federal Express has expanded its operation to encompass more than 400 flights and 1.7 million packages daily, making it the world's largest express carrier (5,6). Aircraft depart from outlying destinations to arrive at Federal Express's Memphis "superhub" between midnight and 1:00 a.m. Within 2 hr, cargo is sorted in a specially designed terminal and reloaded onto planes bound for the shipments' final destinations. A fleet of 31,000 vehicles is available to deliver packages and other freight to customers' doors (6).

The world's four major express companies are in the process of building global hub systems. In Europe, for example, DHL operates a hub in Brussels and is developing a same-day delivery system in Germany with Lufthansa Airlines; Federal Express, rebounding from earlier setbacks in Europe, is developing a minihub operation in Paris; TNT is building a hub in Cologne, Germany; and UPS is developing an expensive ground-based delivery system throughout Western Europe (2).

Integrators also are preparing for major expansion in Asia through the following:

- Federal Express unveiled plans in November 1993 for a major cargo-connecting complex at Subic Bay Airport. This facility, recently vacated by the U.S. Navy, is 60 mi northwest of Manila and will initially serve three daily flights—probably new A300s. Nevertheless, the carrier emphasizes that Subic Bay is *not* necessarily its future Far East hub. It initially will be used to transload transpacific cargo, not to sort inter-Asia express shipments (7).
- TNT opened a minihub in Manila in June 1993 to provide overnight service between Taiwan, Singapore, the Philippines, and

Brunei, using BAe-146 aircraft (8). The carrier is planning to expand this operation to 11 cities by 1995 and currently is negotiating with Hong Kong, Kuala Lumpur, and Bangkok for the necessary traffic rights. Many consider this to be a preemptive move intended to deter competitors from launching hubs of their own.

- DHL is making huge investments in major terminal facilities in Singapore and Japan and is opening express centers throughout mainland China (9).
- To keep pace with its competitors, UPS is purchasing new widebody aircraft to provide expanded service in the Asian market.

### LOCAL HUB BENEFITS

The metropolitan area that becomes Asia's major express hub will reap several significant benefits.

First, it would receive improved cargo delivery schedules. A local hub would provide more attractive "closeout" times (i.e., terminal deadlines) and offer more nonstop service to shippers than an out-of-town hub. Shippers located in hub cities will be able to deliver cargo as late as 10:00 p.m. for overnight shipment, compared with deadlines of 5:00 p.m. in cities that are merely spokes for offshore hubs. A local hub also would help lower terminal rates and hasten the development of an advanced electronic data interchange system.

Second, a local express hub could cause dramatic reductions in air cargo rates. Relatively few carriers currently provide freighter service between major Asian markets (2). Studies by Gellman Research Associates (1990) and Schwieterman (1993) show that the entry of U.S. cargo airlines into concentrated intra-Asian markets could lower prices by at least 5 percent (2,10). These studies show that the annual benefits to shippers from heightened price competition could exceed \$100 million (U.S.) in large metropolitan areas such as Hong Kong.

Finally, a local hub would provide substantial new revenues for the airport authorities through additional landing and parking fees. If the hub were to support 25 daily arrivals and departures, for example, it could generate \$25 million to \$32 million annually in such fees. [These estimates are based on a hub operating 6 days per week and generating aeronautical fees of \$3,200 to \$4,100 per departure (2).]

These aeronautical revenues would strengthen an airport's financial position. Even if an airport observes the rules of the International Air Transport Association (IATA) which prohibit airports from charging aeronautical fees in excess of long-run average costs, its fees will exceed marginal costs. In Hong Kong, for example, the airport authority expects operating costs at its new airport to initially offset just 30 percent of aeronautical revenues, and it will apply the remaining 70 percent of these revenues toward airport debt (11). Increased flight activity at the hub also will boost commercial revenues, franchise fees, and land rentals around the airport.

### COMPARATIVE SITE ASSESSMENT

Airports in five cities—Hong Kong, Manila, Shenzhen, Singapore, and Taipei—are leading contenders to become Asia's dominant express hub. This section analyzes the strengths and weaknesses associated with these leading sites and compares them with those of Bangkok, Kuala Lumpur, and Osaka (Nagoya), which also are vying for additional express cargo business. Each hub site is con-

sidered on the basis of five technical criteria: airport capacity, location, size of the local market, terminal services, and route authority. The results show that hub sites in South China, particularly Hong Kong and Taipei, have decided advantages but must adopt new government policies if they are to remain serious hub contenders.

### Airport Capacity

Each of the leading hub candidates has, or eventually will have, adequate capacity to support a major hub:

- In Shenzhen, China, located in the booming Pearl River Delta and only a short distance from Hong Kong, a new 24-hr international airport opened in October 1991 (1). A second runway is scheduled to open by 1997. Roads and other infrastructure near this airport, however, still are inadequate, rendering a major hub at Shenzhen infeasible for about 2 years.
- In the Philippines ample capacity exists at both Manila International Airport and nearby Subic Bay Airport to support a major hub. The international airport at Cebu also is attractive to express carriers.
- In Singapore, Changi Airport recently was doubled in size and eventually will expand to four terminals and three runways (12).
- In Taiwan capacity exists at Taipei's Chiang Kai Shek Airport to support a major hub. Officials are drafting plans to make the airport the leading transportation center in Asia, with three runways and one of the world's largest cargo terminals (13).
- In Hong Kong a new 24-hr, two-runway airport on reclaimed land around the island of Chek Lap Kok is scheduled to open in late 1997 (11). This will alleviate the severe parking space shortages, congestion, and nighttime curfews that limit cargo expansion opportunities at Hong Kong International Airport (Kai Tak).

Because of contractual disputes, there is growing concern that Hong Kong's new airport will not be finished until 1998—a costly delay that could prevent Hong Kong from participating in the early stages of hub development. Nevertheless, Hong Kong still could play a major role in a hub's later developmental stages. Express carriers could relocate to Hong Kong upon completion of Chek Lap Kok if that facility proves to be the best site and can avoid further construction-related delays.

New airports also are either under construction or already completed in Bangkok, Kuala Lumpur, and Osaka (14).

### Location

Prospective hub sites differ markedly geographically. The following analysis considers the proximity of each hub site to 15 major Asian cargo centers: Bali, Indonesia; Bangkok, Thailand; Beijing, People's Republic of China (PRC); Guangzhou (Guangdong), PRC; Hong Kong; Jakarta, Indonesia; Kuala Lumpur, Malaysia; Manila, the Philippines; Osaka, Japan; Penang, Malaysia; Seoul, South Korea; Shanghai, PRC; Singapore; Taipei, Taiwan; and Tokyo, Japan (Figure 1). These cities are among the region's largest air cargo centers and represent all the region's major industrial powers.

To serve these cities with minimum flight costs [costs are measured using published IATA Great Circle distances (15)], the Asia-Pacific hub would have to be in the South China region—precisely where capacity shortages are most severe (Table 1, Column a). For

example, the operator of a Hong Kong hub could serve these cargo centers with 28 683 km of flight service, compared with 30 552 km at a Taipei hub, 31 620 km at a Manila hub, and 39 031 km at a Singapore hub. (The Hong Kong and Shenzhen sites, separated by only about 100 km, are almost equally attractive.) This means that the operator with a hub in Hong Kong could serve the region's 15 largest markets with 6.2 percent fewer flight miles than with a Taipei hub, 10.2 percent fewer flight miles than with a Manila hub, and 36.7 percent fewer flight miles than with a Singapore hub. Clearly, Hong Kong and Shenzhen have formidable advantages of location.

Operating costs would differ vastly between hub sites. On the basis of average fuel costs of \$2.60/flight-km [the average reported by Federal Express Airlines in 1992 (16)], a Hong Kong hub would save \$2.4 million to \$10.7 million annually relative to hubs outside the South China region (Table 1, Column b). By reducing the number of flight hours, crew expenses also would be reduced.

Flight distance, however, is not the only relevant criterion in evaluating a hub's location. Flights to certain markets, such as Tokyo and Seoul, will carry more cargo than those serving smaller markets, such as Bali or Penang. It is appropriate to weigh these larger markets more heavily in the analysis by considering the different number of tonne kilometers associated with each hub location.

If the amount of express cargo shipped to each destination is proportional to the destination's 1991 total air cargo throughput (see Table 2 for a discussion of the methodological approach), the hub would have to be 500 km east of Hong Kong to minimize total tonne kilometers. This shift occurs because markets in the eastern part of the region tend to be larger than those in the western part. The operator of a Taipei hub could serve the 15 major markets with 10.4 percent fewer tonne kilometers of service than with a Hong Kong hub, 28.8 percent fewer tonne kilometers than with a Manila hub, and 91.2 percent fewer tonne kilometers than with a Singapore hub (Table 2, Column a). Thus, a Taipei hub would have important logistical advantages, whereas Kuala Lumpur and Singapore would have inherent limitations as hubs.

Prospective hubs in South China are equally impressive with respect to *average travel distance*. Under the same set of assumptions, the average shipment would travel 3224 km from its origin to its destination using a Taipei hub and 3575 km using a Hong Kong hub (Table 2, Column b). By contrast, shipments using hubs in Manila and Singapore would travel 4141 and 6177 km, respectively. These differences are important because they show that the South China hub could cut travel times by as much as 5 hr per shipment (Table 2, Column c). For an operator with a Taipei hub, for example, the average travel time would be about 5½ hr per shipment, compared with 7 hr for a Manila hub and more than 10½ hr for a Singapore hub. Clearly, a carrier with a South China hub could offer customers the most attractive delivery schedules.

Political and economic factors, such as language, ethnicity, and economic growth, also will affect the demand for express cargo service. Moreover, the mix of cities to be served will affect the attractiveness of each prospective hub site. For example, if Southeast Asian markets such as Cambodia, Laos, and Vietnam were to be served, the hub would have to be about halfway between Hong Kong and Taiwan to minimize total tonne kilometers. Alternatively, if major cities of eastern India, such as Calcutta and Madras, were to be served, the optimal site would be about 200 km west of Hong Kong, near Hainan Island, China. Under most scenarios, however, the optimal hub location remains squarely within the South China region.

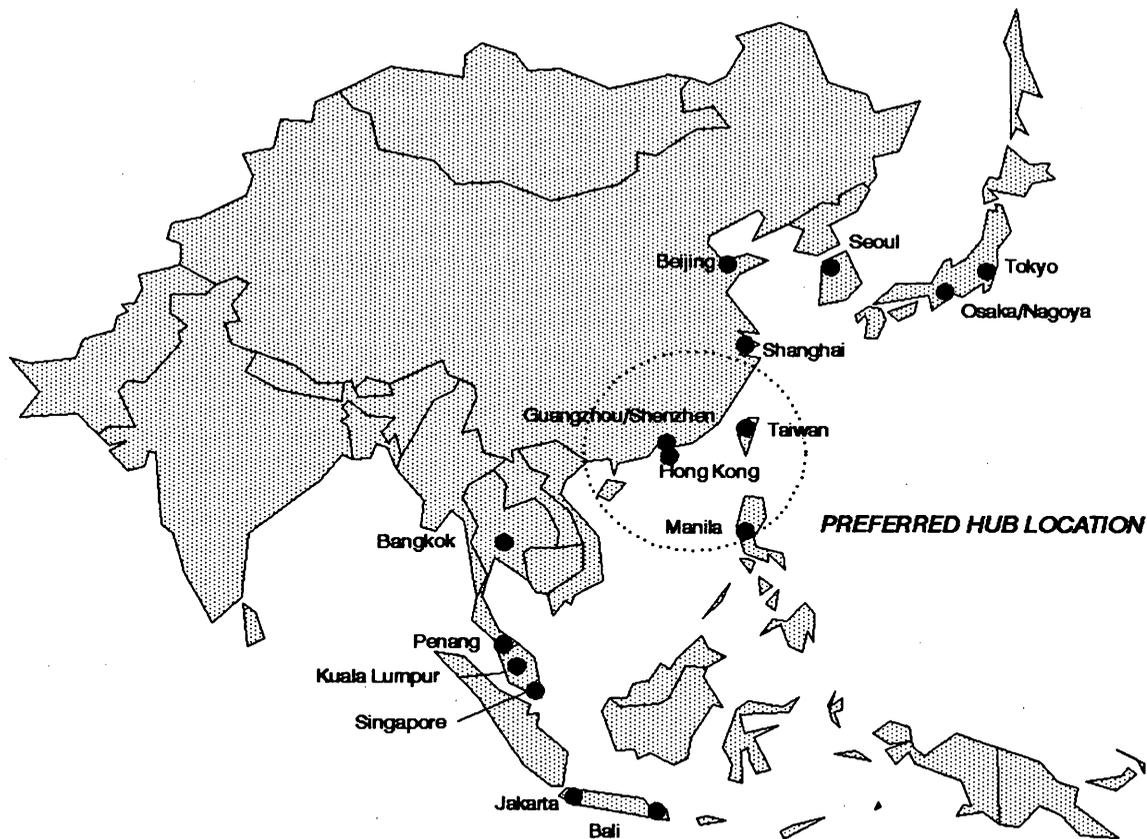


FIGURE 1 Major air cargo markets in the Pacific Rim.

TABLE 1 Cumulative Flight Distance by Hub

Hub Location	(a) Cumulative - Flight Distance -		(b) Annual Fuel Cost vs. Hong Kong
	Kilometers*	Index*	(millions of USD)**
Hong Kong	28,683	1.000	--
Shenzhen	29,331	1.022	+\$0.5
Taipei	30,552	1.065	\$1.6
Manila	31,620	1.102	\$2.4
Bangkok	35,667	1.243	\$5.7
Kuala Lumpur	38,546	1.344	\$8.0
Singapore	39,031	1.361	\$8.4
Osaka	41,817	1.458	\$10.7

\* Flight distances to serve 15 major Asia-Pacific cargo destinations (IATA Great Circle distances). The index numbers are based on distances relative to a Hong Kong hub.

\*\* Based on \$2.60 fuel cost per flight kilometer.

TABLE 2 Cumulative Tonne Kilometers by Hub

Hub Location	(a) Cumulative Tonne kilometers (Index)*	(b) Distance Flown per Shipment (Kilometers)*	(c) Average Travel Time**
Taipei	1.000	3,224	5 hrs. 22 min.
Hong Kong	1.109	3,575	5 hrs. 57 min.
Shenzhen	1.140	3,675	6 hrs. 7 min.
Manila	1.288	4,141	6 hrs. 55 min.
Osaka	1.330	4,288	7 hrs. 8 min.
Bangkok	1.648	5,313	8 hrs. 51 min.
Kuala Lumpur	1.913	6,166	10 hrs. 16 min.
Singapore	1.916	6,177	10 hrs. 30 min.

\* Based on a hub serving 15 major Asia-Pacific cargo destinations (IATA Great Circle distances). The amount of tonnage generated in each city is assumed to be proportional to that city's 1991 total air cargo throughput. This tonnage is distributed across each destination proportionally to the destination's 1991 air cargo throughput <17>.

\*\* Based on Federal Express 1992 system average of 600 kilometers per hour.

### Size of Local Market

Another important hub criterion is the size of the local market. When substantial business is generated locally, a greater proportion of the cargo can be shipped nonstop from its origin to its destination, thus lowering travel time as well as the costs associated with sorting, loading, and unloading cargo. A large local market also ensures the availability of passenger flights to carry cargo to lesser destinations where demand is too light to support freighters. The belly compartments of passenger flights typically can accommodate up to 10 T of cargo (5).

The local markets of the leading hub sites differ dramatically in size:

- Hong Kong's local market is vastly superior to that of the other hub sites. It has convenient highway access to China's Pearl River Delta and is the world's third largest air cargo market, with annual throughput that is expected to surpass 1 million T in 1994 (1). The operator of a Hong Kong hub would be able to carry nearly 13 percent of all shipments nonstop from origin to destination (Table 3, Column a). Hong Kong also has an extensive network of passenger flights with service to more than 30 international destinations (5).

By minimizing the number of shipments requiring flight connections, a Hong Kong hub could reduce terminal costs. On the basis of conservative assumptions given in Table 3, annual terminal costs at a Hong Kong hub would be between \$2.2 million and \$7.6 million lower than at the other sites (Table 2, column c). A Hong Kong hub also would minimize the costs associated with loading and unloading aircraft, which are not included in terminal fees.

- Singapore and Taipei also boast large cargo markets, with annual throughput of nearly 600 000 T and passenger flights to more than 25 international cities. A hub operator in one of these cities could carry between 8 and 10 percent of its shipments nonstop from origin to destination.

- Manila and Shenzhen currently offer smaller local markets, generating only about 200 000 T of air cargo annually. A hub operator in one of these cities would carry only 3 to 5 percent of its shipments nonstop (17). Whereas a Shenzhen hub could directly serve shippers in Hong Kong, enhancing the size of its local market, the willingness of express carriers to ship their cargo on the congested roads and rail links between these cities remains uncertain. Also, the limited scope of Shenzhen's passenger services, which currently serve only five international destinations, would discourage hub development in that city.

Express hubs can be viable at airports without large local markets. In the United States, for example, major express hubs have prospered in medium-sized markets such as Cincinnati, Ohio; Louisville, Kentucky; and Memphis, Tennessee (18). These, however, are among the largest cities that offer highly attractive geographic locations. Thus, while small markets such as Manila and Shenzhen may still be viable hubs because of their attractive locations, Bangkok, Kuala Lumpur, and Osaka probably will remain unattractive hub sites, offering neither large local markets nor exceptional locations.

### Terminal Services

Terminals will play a decisive role in hub development. They often are the only link in a lengthy, worldwide distribution chain in which carriers cannot exercise complete control over service quality, therefore rendering the link susceptible to communication breakdowns, disputes, and delays. Carriers understand that the quality of terminal services can be guaranteed only when they operate their own terminals or work closely with outside terminal-service operators.

Terminals in Manila and Singapore could quickly accommodate a major express hub. In Manila carriers have been given considerable autonomy with respect to terminal services. Recently, for example, TNT opened a \$4 million express terminal at Manila

TABLE 3 Relative Local Market Size by Hub

Hub Location	(a) % of Shipments Locally Generated*	(b) Annual Terminal Costs vs. Hong Kong (in millions of USD)**
Hong Kong	12.9%	--
Singapore	10.2%	+\$2.2
Taipei	8.8%	\$3.3
Bangkok	6.2%	\$5.4
Manila	5.3%	\$6.1
Kuala Lumpur	5.3%	\$6.1
Osaka	3.6%	\$7.5
Shenzhen	3.5%	\$7.6

\* Based on 15 major Asia-Pacific cargo destinations.

\*\* Based on a hub handling 7.5 percent of intra-Asia cargo (the current share of tonnage handled by express carriers in the transpacific market), with annual total throughput of 400,000 tons. Assumes average terminal cost of \$0.20 per kilogram.

International Airport to support its fledgling local operation. In Singapore express carriers jointly operate the Express Courier Center, which is a unit of Singapore Air Terminal Services. DHL holds the largest investment in this facility, which is ranked by shippers as among the most efficient in Asia (9).

Terminal arrangements are less attractive in Hong Kong, Shenzhen, and Taipei. In Hong Kong terminal services are provided exclusively by Hong Kong Air Cargo Terminals Limited—an arrangement that is unacceptable to express carriers (1,19). Hong Kong, however, has a chance to improve its terminal services. By early 1994 its airport authority will decide whether to award express carriers a license to operate their own terminal at Chek Lap Kok. Because of space shortages, express carriers are not optimistic that the airport authority will grant them this much-needed opportunity.

In Shenzhen there are plans to build a major terminal, the Express Cargo Center. Carriers also have been granted permission to build their own terminals. They remain reluctant, however, to make such investments because of logistical issues associated with doing business in mainland China. Adequate terminals remain at least 2 years away.

In Taipei carriers must use the services of a government-owned terminal provider, Chaing Kai Shek Terminal Services, which is presenting serious problems for Federal Express and other carriers. Customs services are too slow and operating procedures too inflexible to support a major hub. Taiwanese officials repeatedly have denied Federal Express permission to build its own terminal.

Until governments in Hong Kong and Taipei give carriers opportunity to participate more directly in local terminal services, Manila and Singapore will retain this important advantage. Only officials in Shenzhen appear committed to closing this gap soon.

#### Route Authority

Finally, the legal authority to launch new flights within Asia is necessary for hub development. Although the bilateral issues affecting

cargo airlines are discussed extensively elsewhere (20,21), their essential characteristics can be summarized.

Regardless of where the hub is located, governments will need to negotiate new Fifth Freedom Rights, giving carriers the right to carry passengers or cargo between two foreign countries. The outlook in negotiations for new Fifth Freedom Rights is favorable for hubs in Manila, Shenzhen, Singapore, and Taipei because of the amicable relationships between overseas air service negotiators and the respective national governments of these cities. Many U.S. cargo airlines already enjoy virtually unrestricted access to airports in Taipei and Singapore (2). For a major hub to be possible in Taipei, however, officials in Beijing and Taiwan must reach new broad-based agreements so that carriers can offer nonstop services between Taiwan and mainland China, which currently are forbidden. Such agreements are expected soon.

A bitter relationship exists between U.S. negotiators and Hong Kong. The U.S. government has dim hopes that it will be able to negotiate additional rights for Federal Express and UPS in the near future (20). Although the Hong Kong government may be forced to reconsider its policy as the debt for its new airport mounts, attempts to resume the bilateral discussions with the United States that abruptly ended in early 1992 have experienced difficulties. This could thwart Hong Kong's bid to become a major express hub.

#### CONCLUSIONS

With rapid growth in the Pacific Rim, a major express hub appears imminent. Such a hub will fill an important market niche, allowing carriers to collect packages in the early evening and guarantee their delivery to destinations in Asia the following morning. The leading hub candidates are listed in the following, roughly in descending order according to their prospects of becoming a hub:

- *Manila.* Almost by default, Manila has emerged as the front-runner for the hub. It performs above the average, though not spec-

tacularly, for all five criteria. Manila's efforts already are paying dividends as Manila becomes the focal point of the expansion plans of TNT and Federal Express. Political unrest in Manila and the country's struggling economy remain the primary disadvantages of a Philippine hub.

- *Taipei*. Taipei offers a large local market, liberal air service agreements, and available airport capacity. The operator of a Taipei hub could serve the region with the fewest tonne kilometers of service. For Taipei to become a viable hub site, however, policy makers must liberalize the market for terminal services, which is controlled by the government. Little progress on this front is expected in the near future.

- *Hong Kong*. Hong Kong offers an immense local market with convenient ground access to mainland China and an excellent geographic location. A hub in Hong Kong could serve major Asian markets with the fewest flight hours of service. However, Hong Kong must overcome three glaring deficiencies—curfews and capacity shortages at its existing airport, inadequate terminal facilities, and restrictive air service agreements—before it can become a serious candidate. Hong Kong will have to take steps to encourage express carriers to postpone their hub development plans until at least 1997, when Chek Lap Kok is scheduled to open. This will require awarding new Fifth Freedom Rights and authorizing express carriers to build their own terminal facility at the new airport.

- *Shenzhen*. Shenzhen's excellent location and eagerness to provide quality terminal services may not be enough to overcome the small local market and poor infrastructure around its new airport. Its proximity to Hong Kong could provide hub operators with convenient access to an immense local market, but the absence of passenger flights will remain a pressing problem.

- *Singapore*. Changi Airport in Singapore is attractive in all respects except for its remote location, which would require highly circuitous flight routings. Singapore's best hope may lie in marketing itself as a smaller hub that would focus on the Southeast Asian market.

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