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The impact of sea-air mode on air cargo transport

DEPARTMENT OF AERONAUTICS,
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Supervisor: R. Doganis.

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Ghanem Al-Hajri.

Abstract

The following research looks into the concept of sea-air intermodality, a combination of two or more modes of transport for the carriage of goods from origin to destination. The study examines why and how this form of transport evolved to become a viable alternative to the conventional single modes of ocean and air transport.

The viability of the sea-air mode depends on various equally important factors which are analysed in depth, with a special emphasis on the sea-air transfer port. In this context, research findings of the world's existing sea-air hubs are recorded and evaluated in terms of their present and future trends.

At a sea-air transfer hub, ocean cargo is converted to direct air freight, thus adding new volumes of air cargoes. In this respect, sea-air plays a positive role in the present and future development of the air freight industry.

The impact of the sea-air mode can be most clearly seen in the case study analysis in Chapter 10 of this thesis, whereby the potential for 'convertibility' of large portions of low density ocean cargoes to the sea-air mode, is successfully demonstrated.

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Glossary

ACI	*Airports Council International, HQ, Geneva.*
ADIA	*Abu Dhabi International Airport.*
AF	*Air France.*
APL	*American President Lines.*
ATK	*Available tonne-kilometres. A product of the maximum cargo-weight carrying capacity of an aircraft, in tonnes, and the distance in kms for any given sector.*
AWB	*Air Waybill. An air transport document issued by the airline, covering the carriage of goods from airport to airport.*
AZ	*Alitalia.*
belly-hold	*Compartment/s,located in the lower deck of the aircraft, used for the carriage of passenger baggage and cargo.*
B/L	*Bill of Lading. An ocean transport document issued by the shipping line, covering carriage of goods from port to port.*
bulk cargo	*Loose cargo to be loaded on bulk ships.*
CAAS	*Civil Aviation Authority of Singapore.*
cbm	*Cubic metres.*
CIF	*Cost, Insurance, Freightage*
CIS	*Commonwealth of Independent States (ex USSR).*
combi	*Aircraft configured to carry both passengers and cargo on the main deck.*
consignee	*Receiver of ordered goods.*
consolidated-cargo	*Individual shipments grouped together and forwarded under one airline AWB to one destination.*
container	*Unit Load Device.*
CTD	*Combined Transport Document, covering two or more transport modes.*
CV	*Cargolux.*
CX	*Cathay Pacific.*
DCAD	*Dade County Aviation Department, Miami, Florida.*
DCV	*Dubai Cargo Village.*
de-consolidation	*Segregation and break-bulk of individual shipments in a consolidation.*
de-stuffing	*Segregation/breaking down of combined cargoes.*
DNATA	*Dubai National Air Travel Agency. Acts as the official government appointed handling agent of all airlines using Dubai Airport.*

DXB	*Dubai (one of the seven emirates that comprise the U.A.E.).*
EEC	*European Economic Community.*
EK	*Emirates Airlines.*
ETA	*Estimated Time of Arrival.*
ETV	*Elevating Transport Vehicle.*
FBL	*FIATA (International Federation of Freight Forwarders Association) Bill of Lading.*
FCL	*Full Container Load.*
Fedex	*Federal Express, the parcel service air carrier.*
FETA	*Far East Transport Association, Hong Kong.*
FIATA	*International Federation of Freight Forwarders Association.*
FJR	*Fujairah (one of the seven emirates that comprise the U.A.E.).*
FLF	*Freight Load Factor.*
FMC	*Federal Maritime Commission.*
FOB	*Free on Board of ready for carriage shipments.*
freighter	*A pure cargo aircraft.*
gateway	*airport or sea port which is a principal entry/exit point into/out of the country.*
GSA	*General Sales Agent.*
HWB	*House Air Waybill. An air cargo transport document issued by a freight forwarder.*
IATA	*International Air Transport Association, HQ, Geneva.*
ICAO	*International Civil Aviation Organisation, HQ, Montreal, Canada.*
ICC	*International Chamber of Commerce.*
ICHCA	*International Cargo Handling Co-ordination Association, London.*
integrator	*A freight forwarder owning and operatingcargo aircraft.*
intermodality	*The use of two or more modes of transport mode in the carriage of a shipment from origin to destination.*
in bond	*Goods which are sealed during storage or transport, until released by customs.*
ISL	*Institute of Shipping and Logistics, Bremen, Germany.*
KU	*Kuwait Airways.*
LAX	*Los Angeles Airport.*
L/C	*Letter of Credit.*
LCL	*Less than full container load.*
LD	*Air Hong Kong.*
MP	*Martinair.*
NAFTA	*North American Free Trade Agreement.*

NLA	*New Large Aircraft.*
NVOCC	*Non Vessel Owning Common Carrier.*
OECD	*Organisation for Economic Co-operation and Development.*
Pacific Rim	*Includes the countries; Japan, S. Korea, Thailand, Indonesia, Hong Kong and Taiwan.*
palletising	*Building up of cargoes on air pallets for eventual loading on the main deck of the cargo aircraft.*
perishables	*Fresh foodstuffs, flowers, vegetables.*
PSA	*Port of Singapore Authority.*
RJ	*Royal Jordanian Airline.*
SAOA	*Sea-Air Operators' Association, U.A.E.*
SDR	*Special Drawing Right.*
SEA-TAC	*Seattle-Tacoma.*
SFO	*San Francisco.*
shipper	*Sender of goods ordered by a consignee.*
SHJ	*Sharjah (one of the seven emirates that comprise the U.A.E.)*
SQ	*Singapore Airlines.*
STDB	*Singapore Trade Development Board.*
SU	*Aeroflot.*
TEU	*Twenty foot Equivalent Unit (20' container).*
UCP	*Uniform Customs and Practices for Documentary Credits*
ULD	*Unit Load Device (containers used for air or ocean carriage of cargo).*
UNCTAD	*United Nations Conference on Trade and Development.*
yield	*Revenues.*

Part I: *The development of sea-air.*

Chapter 1

Introduction

1.1 Aim and scope of the field research

The aim of this research is to examine and throw light on the emergence of sea-air intermodality as a reliable mode of transport, through an analysis of all available international sea-air routes, and especially the route from the Asia-Pacific region, via various intercontinental transfer hubs to Europe and other parts of the world, such as South America.

Traditional modes of transport, namely those of direct ocean shipping and direct air freight, have also been analysed in relation to the sea-air mode, with focus on the transit time and costs of each mode, to the general users.

Hypothesis

Sea-air intermodality, as a reliable mode of transport, has an important role to play in the future development of the air freight industry.

The main objective of this thesis is to prove that sea-air intermodality has a definitive and positive role in the present and future development of the air freight industry. Such a positive role is fully analysed with respect to its direct effects on the main components of the air cargo industry.

A. To the air carriers of cargo :

By attracting a higher percentage of specific classes of cargo, such as :

a. high value goods,

b. high volume, low density cargo shipments having much higher cubic volume in relation to their deadweight,

away from direct all ocean shipping to the sea-air mode, thus providing increasing quantities of cargo to many world airlines' unutilised cargo capacities.

B. To the end users :

By reducing total distribution costs and transit time, in addition to a faster replenishment of capital.

C. To the shipper at origin :

By providing his clientele, the importers, with a viable and competitive alternative to direct air freight or direct all-ocean shipping.

1.2 Methodology

The sources and references to the subject of sea-air as a mode of transport are limited due to the short period since its emergence.

1. Records and references were used sparingly as a first step to define certain processes accurately. Periodicals, papers, sea-air conferences, presentations and papers, international transport conferences, records, specialised magazines and periodicals, were also used to draw up a clear picture of the activities of the sea-air industry, such as the sea-air routes, statistics and figures relating to costs of transport related charges, transit time and ground facilities of the transfer point.

2. The second step was the designing of three types of questionnaires which were meant to collect accurate information and data about the activity and the role of each transfer point. The questionnaires were directed to :
   a. Airport Authorities
   b. Seaport Authorities
   c. Freight Forwarders at origin and at the transfer points.
   d. Consignees.

   The questionnaires were designed to create a 'mini case' study of the main sea-air transfer points covering the general developments of the sea-air movements from as early as the late 1950s up to the late 1980s, with a specific and accurate analysis over a five year period starting in 1989 and ending in 1994.

   I. Definition of the current size of the market in the West Coast of Canada and the United States (Vancouver, Seattle - Tacoma, Los Angeles and San Francisco), Singapore, U.A.E. and Vladivostok.
   II. Analysis of the competitive position of each gateway vs the other. This included analysis of average total transit time, market pricing, availability of air lift, carriers and forwarders handling sea-air cargo, dock to airport transfer time, handling cost etc.
   III. Identification of the characteristics of the transfer hub, including strengths and weaknesses, risks and opportunities for growth, identification of new markets and service improvements.

3. The third step was the field research which was by far the most important in building up this study, as it filled, or rather bridged, a very important gap caused by:
   a. the inaccuracy of available public data,
   b. the lack of references and serious studies on the subject of the sea-air mode.

The field work was started in March 1992 and terminated in August 1995, and was divided into stages of field visits and meetings with a targeted group of key people and institutions, at the regional level of the sea-air transfer hub.

A. The targeted groups were:
   1. Airlines
   2. Shipping Lines
   3. Airports
   4. Sea ports
   5. Freight forwarders

B. In the first stage, the targeted hubs were:
   1. North American West Coast
      Vancouver, Seattle, San Francisco, Los Angeles and Miami on the East Coast.
   2. Singapore
   3. United Arab Emirates
      Dubai and Abu Dhabi, with Sharjah being my base.
   4. Vladivostok
      Seoul and Tokyo being the only users.

C. In the second stage, visits and interviews were directed at the sea-air originating points:
   1. Hong Kong
   2. Japan
   3. Taiwan
   4. Korea
   5. Singapore
   6. India

The meetings, whether at the sea-air transfer hubs or at originating points, were meant to find out accurate data and figures and to identify any apparent trends. More especially, the aim was to establish:
1. Official records of actual cargo tonnage movement by airline, region and country.
2. Imports/Exports tonnage and value.
3. The general attitude of the port and airport authorities toward sea-air movement.
   a. Facilities
   b. Related charges
   c. Transit, 'in bond', movements as a percentage of the total.

4. Attitude of the shipping lines to sea-air cargo, in terms of facilities and charges.
5. For airlines carrying sea-air cargo
    a. Type of commodity - value.
    b. Low density, high volume in relation to weight - charges.
    c. Transit time and airport to airport costs.
    d. Shares of each airline of sea-air tonnage and future trends.

6. For freight forwarders :
    a. Volume/tonnage share.
    b. Facilities.
    c. Hindrances and problems.
    d. Transit time, costs of transport and related charges.
    e. Market size.
    f. Government rules and regulations in relation to sea-air.
    g. Seasonal fluctuations.
    h. Sea-air market trends.

D. In the final stage, visits to the major sea-air destinations in Europe were undertaken. The objective was to determine the reasons behind their use of the sea-air mode, in relation to other modes - and their future plans. End users were very hard to interview. However, through the help of the freight forwarders, joint visits were made to consignees, the actual decision makers specifying the use of a certain mode of transport. Consignees in London, Manchester, Frankfurt, Hamburg, Cologne, Amsterdam and Copenhagen were jointly visited with the relevant freight forwarders in the area.

The majority of the questions centred on :

1. Costs and transit time.

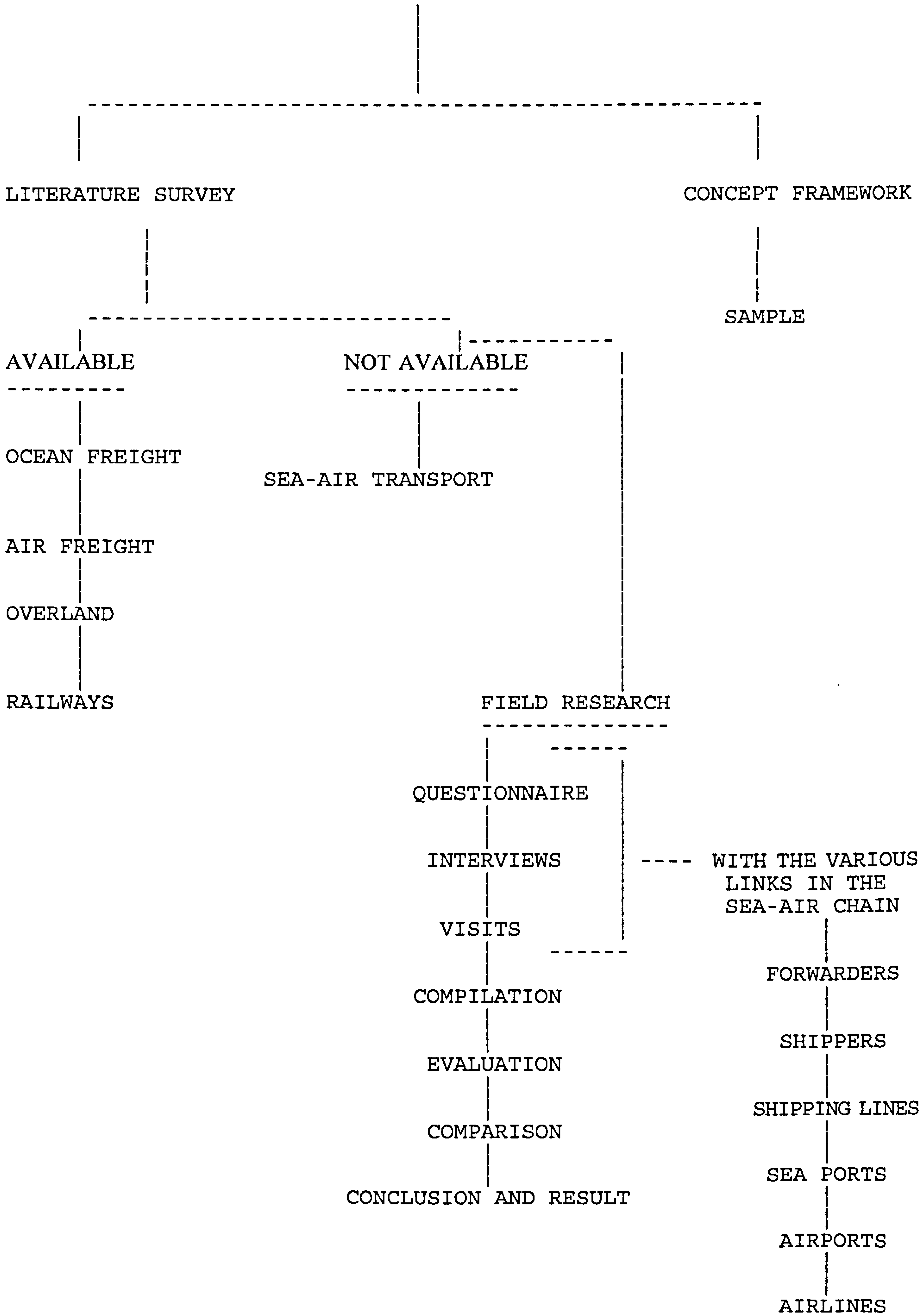
2. Inventory and stockpiling costs savings.

3. Arrival of shipments at the airports rather than the ports (easier and faster to clear customs clear and get the product to the market).

4. Difficulties at the port of segregating LCLs (less than container loads shipments) and the resulting delay of two days.

5. Sea-air mode as a viable and reliable alternative to the other two modes.

METHODOLOGY



1.3 Chapter development and scheme

The research has been divided into three parts.

Part I defines sea-air intermodality and identifies factors for its development. One of the major factors is the availability of air cargo capacities at transfer points. To identify this capacity, the growth of wide-bodied aircraft from inception in 1969, to 1994, is researched together with the degree of utilisation of the huge air cargo space that became available. For the first time ever, a freight load factor has been derived from world scheduled international tonne-kilometres available in relation to tonne-kilometres performed.

Further, on the regional level, distribution of air cargo capacities of world scheduled international passenger, pure freighter and combi services, by aircraft type and by regions of international operations, were computed and a percentage share of international air cargo capacity available by type of aircraft and region, was reached and then related to the percentage distribution of international scheduled air cargo traffic by region, yielding a freight load factor, and therefore unutilised air cargo capacities by region and route groups, that represent the grounds for potential sea-air routes.

Part II traces the history of the early sea-air routes of the 1950s, and how they faded away mainly because of air cargo capacity problems. Sea-air intermodality had to wait till the late 1970s and early 1980s to take its contemporary form and make deep inroads into converting large portions of pure ocean cargo into the sea-air mode. The present day sea-air routes were divided into two route groups. The easterly route covers sea-air traffic moving via the transfer hubs of Vladivostok, Singapore and the U.A.E. to Europe and parts of Africa, and the westerly route covers traffic moving via the North American hubs of Vancouver, Seattle, Los Angeles, San Francisco and Miami to Europe and South America. The growth and development of the sea-air traffic is subjected to detailed analysis in relation to the sea-air transfer points of the world.

Part III focuses on the characteristics and requirements of viable sea-air transfer hubs, their geographic location and the facilities provided by governments to the ports and airports. The study further provides an in-depth analysis on the role of the key players, the ocean and air carriers, in terms of port and airport selection strategies and the freight forwarder in his capacity as sea-air operator. The 'Conclusions' show that the sea-air mode has developed to become a reliable and viable alternative to the conventional modes through its ability to convert large portions of ocean freight to direct air freight at transfer hubs, which in turn opens the door for new freighter services to enter the market at these points of conversion.

Chapter 2

The transport system and intermodality
A Preface

2.1 The transport system

Transportation is a system that aims at moving people and goods from one point to another. The factors that govern this movement are: (a) centres generating supply and demand, and (b) the many components of the system itself. A proper analysis must take into consideration the whole network of variables that make up the transport system. These variables may be classified as macro and micro variables. The political and economic system generates the macro variables, whereas technology, transport modes and logistics constitute the micro variables. A brief summary of these variables, as an introduction to the more detailed discussion of intermodality, becomes necessary.

2.1.1 The micro variables :

The three micro variables (technology, transport modes and logistics) are inter-related.

a) Technology[1] : Transportation systems have been changing rapidly during the last five decades. The period between 1950 and 1960 witnessed the economic recovery of the western world from the after effects of the Second World War. Huge volumes of goods were shipped on old and slow fleets of conventional general cargo vessels, to many destinations. Ports, however, were unable to cope with this increased traffic because of inefficient port facilities and old equipment. This led to congestion of ships waiting to offload, and effectively a very slow turnround of ships at ports of origin and destination, inevitably resulting in significant time loss. This necessitated the changes that were required.

As regards to facilities at ports, the changes came about with the introduction of gantry cranes and specialised cargo terminals. Available open land space, around the ports, was utilised as cargo container stations to meet increased traffic. In many instances open land space was not available around the ports, forcing cargo terminal construction deeper inland. Further, the introduction of newly equipped offloading devices and larger barges resulted in much improved ship-to-port handling, all of which achieved a faster turnround of ships. Standardisation of cargo handling equipment, unitisation and containerisation were introduced. Simultaneously, there was the development of new types of vessels in the international trade scene (cellular ships, straddle - con bulk - vessels, LASH and Roll-on, Roll-off carriers).

1.Abrahamsson, B.J. (1980) 'International Ocean Shipping - Current Concepts and Principles' (Boulder Westview Press) - progress in shipping technology, pp 1 - 60.

b) Transport modes: are ways and means by which goods move from one point to another. General cargo is carried by three major means of transport; overland (rail and trucks), water and air. The increased flow of international trade called for higher efficiency in terms of speed of delivery. This aspect, together with competition among various modes of transport, led to further development of these modes. Competition was generally limited to the speed of delivery of each mode, whereas, the competition within each mode was instrumental in bringing about changes in the form of innovations in design, size and engines, in the components of each mode of transport.

In ocean transport, the change was from slow and old, conventional general cargo ships to faster and specialised bulk carriers, faster and larger cellular container vessels, and highly efficient barges. In the air transport industry, the change was to wide-bodied jet freighters. And in the case of overland transport, there were two major changes. First, in the trucking system, there was the introduction of a new tractive unit and standardised trailers specially designed to load 40 ft and 20 ft standard sized containers from onboard ships to onboard tractive trailers. Second, in the rail transport system, the change was from the old conventional box car to the twin deck container cars.

c) Logistics[1] :is defined as "the physical distribution of goods". Some even go further and define it as "control of material flow from the assembly line, ex factory, to the end user". In decision making, transport operators consider transportation and logistics together. For instance, when the selection of a certain mode or modes of transport is made, the container size and the choice of a transhipment or a transfer port are both considered together.

Logistics, as the control of the flow of goods from one point to another, implies that a workable communication system connecting centres of supply and demand, should function in order to achieve and maintain control over the flow of goods. This entails co-operation between the transport modes and within each transport mode itself. Fast, reliable communications are the key to effective control over the flow of goods, whether in containers or in specialised bulk ships, or onboard trucks, or in air cargo containers. To maintain a reliable communication system, co-operation becomes necessary within the mode of transport itself, and among carriers and operators of that mode. By the same token, co-operation among various modes of transport becomes necessary when more than one mode of transport is used. Keeping track of cargo containers is important to operators, in their efforts to maximize container use, and to the consumer, who, by an operator's pre-alert message, is informed of the exact arrival details of goods ordered. Feedback of information to the shipper on the progress of cargo movement generates confidence in the system as a whole.

1. Wallace I.L (1974) 'Transportation Regulation Management and National Policies' (Seattle: University of Washington), chapters 1, 2, 3 and 4.

2.1.2 The macro variables[1]:

a) **The political and economic system :** determines, to a very large extent, the framework within which the transportation system operates. The economic environment is inter-related with the political system, and this interaction determines the degree of impact on the transportation system. This relationship differs between regions. Productive regions require an efficient transportation system to move products from the centres of production to the consumer markets.

Changes in production or consumption patterns, whether domestic or international, have a direct and instantaneous effect on the transport system as a whole. The demand for a transport mode in a region depends largely both on other regions' demand for the product of the exporting region and on each region's internal demand and production patterns. Therefore, an efficient transport mode [efficient is defined as low cost of operation, availability of fast and large carriers and proper control ("logistics") of the flow of goods], can act as a positive factor in the economic growth of any region.

The political system or the impact of government intervention on the transportation system, and its modes, can be clearly defined.

b) At the local level : the political and economic environment impacts in numerous ways, such as restrictions on vehicle size and payload on the motorways and on safety and road maintenance. Restrictions on the use of engines, by prohibiting the use of diesel engines on heavy-duty transport vehicles (for environmental considerations), restrictions on the movement of truck transport to certain hours during a working day, and a complete ban on trucking during weekends. These restrictions have a direct impact on the movement of cargo from the production line to the end users, in terms of delays in deliveries and in higher costs of transport.

c) At the state level : the government can impose regulations on basic elements of the transportation system. Such regulations may include (a) controlling the flow of foreign capital to the transportation system, (b) the regulation of the rate structure, (c) the allocation of international routes to national carriers, (d) the co-ordination between transport modes, (e) the application of preferential tariffs on certain classes of goods and (g) the creation of barriers and protectionism and so on. Therefore, in developed economies, the easing of regulations, the cutting of unnecessary red tape, free and open-sky policies, free capital inflow and outflow, the availability of facilities at ports and airports, the removal of tariffs and other barriers, will encourage development by motivating entrepreneurs to increase investments in various aspects of the transportation system.

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1. On variable aspects of transportation that can be changed directly by the decision of individuals, groups or institutions. See: Manheim, M. L. (1974) Fundamentals of Transportation System Analysis (Cambridge: MIT, preliminary edition).

2.2 The emergence of intermodality

During the period between 1980 and 1990, a very important development in the field of transport was witnessed. There was a shift of emphasis from equipment innovation, to organisation and logistics. The question was, 'How should a transportation system operate to ensure maximum efficiency?'. Maximum efficiency meant satisfying consumer demand, by 'in time' deliveries of goods from the production centres to consumer markets, at the lowest possible cost. In order to achieve greater efficiency, (a) the costs of the transportation system, as a whole, should be reduced, (b) effective control over the flow of cargo should be maintained, and (c) co-operation and co-ordination amongst the various transport modes should be geared to a high level for the success of the whole system.

Amongst the factors mentioned above, the key element is the *control of the flow of cargo*. As a result of developments, the structure of cargo flow from origin to destination, within a specified period of time, involving the use of two or more modes of transport, became the order of the day. Therefore, route selection and modal choice[1], together with physical distribution and logistics, became a necessity in the control of cargo flow. The use of two or more modes of transport entails an interchange or a transfer point. The conventional function of a transfer point was to transfer goods from one mode of transport to another.

The terms 'break bulk' and 'terminal', often used in transport terminology, indicate clearly the end of one transport mode and the beginning of another. To minimize 'break bulk' or stoppage time at transfer points is of crucial importance to the survival of intermodality, as cargoes must 'connect' in time, with the next mode, at the transfer point. 'Continuity' of the flow of cargo must be fully under control.

Inter-modality[2] is defined as the movement of cargo between two points from shipper to consignee, using at least two different modes of transport, a single rate, and a combined transport document (CTD)[3] with a defined liability, for the whole journey. The objective is to transport goods in a continuous and controlled flow, from origin to destination, with the least cost and time. Intermodality is a flexible and evolving response to the dynamic demand of the market place and its distributional requirements. Cargo movement, under intermodality, is viewed in the light of the total distribution system, which includes producers/shippers, carriers (ocean, land and air), freight forwarders, airports/sea ports and inventory - warehousing.

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1. is a choice of a mode of transport.

2. Faust P. (1985 'Multimodal Transport', Bremen: 'Institute of Shipping Economics and Logistics', pages 200 - 236.

3. Combined Transport Document is a contract combining two or more modes of transport (sea + air, or sea + air + overland etc.), and is issued by a licensed freight forwarder on behalf of the shipper, for the carriage of goods from one point to another, using various modes of transport, and according to 'conditions of carriage' as printed on the back of the CTD.

The use of various modes of transport entails an interchange point, at which moving goods come to a halt. No matter how brief this halt, it does stop the continuous flow of goods, between two set points. This is so because the kind of goods transported include general cargo that moves in containers, in loose form (cartons, crates, boxes etc), and in a variety of shapes and sizes that may or may not be suitable for the next mode of transportation.

For example, intermodal cargo arriving by ocean at a transfer point in standard-sized containers for eventual transfer to other modes of transport, will be subject to some delays if the next mode of transport is air, since the containers must be offloaded, and their contents destuffed, to be then regrouped into air pallets, or air containers, for eventual air carriage to final destination.

Thus, the time lapse of this transfer, no matter how brief, causes an interruption in the flow of goods. Whereas, in the case of overland transfer, (if that happens to be the next mode of transport), there is hardly any stoppage at the transfer point, as the ocean container in question is simply required to be loaded on flat trailers or chassis on wheels, and hooked on to tractive units. Then, provided the 'in bond' customs clearance is done on time, the flow is virtually non-stop to the final destination. This transfer of goods, between two or more modes of transport, is referred to as an intermodal transfer.

Stoppage of cargo that occurs at the transfer point is a major weakness of intermodality. Hence the availability of transfer points, providing transit without any superficial hindrance, leading to a minimum of stoppage time, is one of the major factors governing intermodality. Sea-air intermodality involves most known modes of transport: ocean, air and overland.

Chapter 3

Air carriers and sea-air intermodality

3.1 Air cargo capacity and freight load factor

The trend of involving air carriers with sea-air intermodality started in the 1980s and is still continuing in full force up to the present time. The factors that caused air carriers to get involved were :

1. The shift of control of cargo movement and cargo flow from the air carriers to the intermodal operators, the 'NVOCCs' (Non Vessel Owning Common Carriers) and freight forwarders.

2. Air carriers' loss of part of their clientele.

How did that happen? This section attempts to analyse answers to this question in detail.

During the period between 1950 to 1970, there were generally two main reasons to use aircraft for cargo movement from one point to another.

1. In cases of emergencies and of an urgent need to carry certain goods over great distances in a short time. As such, the high cost of transporting these goods to their destination was justifiable and acceptable in terms of time saved. All-cargo aircraft were used to uplift emergency goods to remote places where they were most needed, such as relief goods, medicines, food, perishables, etc.

2. Unutilised capacities, available in the compartments and holds of passenger aircraft, made it possible for the passenger airline to derive extra revenue with hardly any increase in the total operational costs. As in the early days of cargo handling, goods bound for air freight were packed in small packages, on skids with nylon or net coverings, in light cardboard boxes, etc, and a light conveyor roller was used to transfer cargo to the compartments of the aircraft, along with the luggage of the passengers.

The introduction of wide-bodied jets, with special reference to the Boeing-747, together with a huge improvement in cargo handling at cargo terminals at airports, and the extension and expansion of runways, all have set the scene for a new era of massive development of cargo movement by air, which started in 1970 and is still in full swing up to the present time. Huge air cargo capacities became available and the airline industry, as a whole, became increasingly concerned about how to fill these air cargo capacities, and maintain their growth and profitability.

Table 1. The development of wide-bodied aircraft vis-á-vis narrow bodied aircraft, 1969 - 1994[1], and the growth per annum, (1969 as base year) Jet aircraft[2] - all operators

Year	No. of wide-bodied aircraft	Increase in number of aircraft	% growth	No. of narrow-bodied aircraft	Increase in number of aircraft	% growth
1969	**16**			**3,456**		
1970	82	66	412.5%	3,675	219	6.3%
1971	153	71	86.6%	3,845	170	4.6%
1972	273	120	78.4%	3,960	115	3.0%
1973	388	115	42.1%	4,145	185	4.7%
1974	**503**	**115**	**29.6%**	**4,344**	**199**	**4.8%**
1975	592	89	17.7%	4,553	198	5.1%
1976	671	79	13.3%	4,664	111	2.4%
1977	733	62	9.2%	4,773	109	2.3%
1978	800	67	9.1%	4,884	111	2.3%
1979	**932**	**132**	**16.5%**	**5,011**	**127**	**2.6%**
1980	1,099	167	17.9%	5,129	118	2.4%
1981	1,200	101	9.2%	5,141	12	0.2%
1982	1,314	114	9.5%	5,268	127	2.5%
1983	1,404	90	6.8%	5,314	46	0.9%
1984	**1,487**	**83**	**5.9%**	**5,317**	**3**	**0.1%**
1985	1,559	72	4.8%	5,466	149	2.8%
1986	1,669	110	7.1%	5,673	207	3.8%
1987	1,754	85	5.1%	5,953	280	4.9%
1988	1,869	115	6.6%	6,217	264	4.4%
1989	**1,955**	**86**	**4.6%**	**6,575**	**358**	**5.8%**
1990	2,145	190	9.7%	7,005	430	6.5%
1991	2,425	280	14.1%	7,335	330	4.7%
1992	2,695	270	11.1%	7,665	330	4.5%
1993	2,761	66	2.4%	8,019	354	4.6%
1994*	**2,955**	**194**	**7.0%**	**8,459**	**440**	**5.5%**

Source: ICAO Circulars 158-At/57, 177-AT/67, 222-AT/90, 244-A/P1/150-12/93

* *1994 figures are forecasted.*

1. *Excluding China and USSR (at present the CIS)*
2. *1969 marks the start of gradual replacements of piston-engined and turbo-prop aircraft by turbo jets of minimum of 9000 kgs maximum take-off weight. By the mid 1970s, jets increased from 49% to 70% of world total and offered over 95% of the world air traffic capacity. Therefore, piston engines and turbo props were dropped from all analysis throughout this study.*

The build-up of wide-bodied aircraft from 1969 onward took a giant stride. Table 1, above, shows this growth from a mere :

16 wide-bodied aircraft in 1969 to
503 by the end of 1974,
932 by the end of 1979,
1,487 by the end of 1984,
1,955 by the end of 1989, and up to 1994, a staggering number of almost **3,000** wide-bodied aircraft in use. While narrow-bodied aircraft grew from approximately **3,500** to almost **8,500** in the 25 years from 1969 to 1994.

This development is further detailed by type of aircraft. Table 2, on the following page, shows wide and narrow bodied aircraft growth by type, for the whole period under review, from 1969 to 1994.

Table 2 Development of world wide/narrow bodied commercial turbo-jet aircraft by type 1969 - 1994 (excluding CIS & China)

World wide-bodied aircraft by type	Year of 1st entry into service	1969	1974	1979	1984	1989	1993[1]	1994[2]
Scheduled :								
Boeing 747	1969	14	232	376	538	650	991	1040
Douglas DC10	1971	-	161	280	323	335	330	330
Lockheed L-1011	1972	-	92	160	208	205	200	200
Airbus 300	1974	-	-	76	222	280	406	430
Boeing 767	1982	-	-	-	98	260	407	440
Airbus 310	1983	-	-	-	41	160	245	280
MD -11	1990	-	-	-	-	-	112	150
Non-scheduled :		2	18	40	57	65	70	85
Total wide-bodied jets		**16**	**503**	**932**	**1487**	**1955**	**2761**	**2955**

World narrow-bodied aircraft by type	Year of 1st entry into service	1969	1974	1979	1984	1989	1993	1994
Scheduled :								
Boeing 707	1958	610	630	515	260	145	-	-
Douglas DC8	1959	470	500	390	245	120	-	-
Boeing 727	1963	735	995	1450	1550	1510	1350	1350
Douglas DC9	1965	490	660	830	990	850	460	400
MD80-90	1985	-	-	-	-	600	1089	1139
Boeing 737	1967	185	340	525	880	1500	2400	2540
Boeing 757	1982	-	-	-	40	225	470	540
Airbus 320	1988	-	-	-	-	120	400	430
Airbus 340	1992	-	-	-	-	-	20	40
BAe146/HS85/180	1983	-	-	-	24	80	220	245
Fokker 100	1988	-	-	-	-	80	225	255
Other narrow-bodied jets*		726	854	891	875	630	583	720
Non-scheduled :		240	365	410	453	715	802	800
Total narrow-bodied jets		**3456**	**4344**	**5011**	**5317**	**6575**	**8019**	**8459**
Grand total wide/narrow bodied jets		**3472**	**4847**	**5943**	**6804**	**8530**	**10780**	**11414**

Source : ICAO Circulars, 158-AT/57, 177-AT/67, 222-AT/90, Doc. - 9180/19, September 1994, and 12/93, A/P1/150.

*. *Other narrow-bodied jets include : British Aircraft Industries : BAe HS 121 Trident, BAC 111, BAC HS-125 and the Anglo French SST. French Aircraft Industries : Dassault 50 Falcon, Mystere 20 Falcon, Mercure, Sud Aviation SE-210. Other European Aircraft : Fokker F 28, IL 62, IL 76, TU 134, TU 154, Yak 40-42. Russian made aircraft for use outside the CIS and China by the rest of the world.*

1. *1993 figures are posted as an indicative factor to 1994 forecast.*
2. *1994 forecasted figures : Method of forecast depended largely on the following facts.*

a. *Order placed for turbo jets totalled US$ 21 billion in 1992 while in 1991 orders were US$ 29 billion, a drop of US$ 8 billion in one year.*

b. *Major aircraft producers declared a policy of reducing rate of production in 1992. MacDonald Douglas and Boeing up to a 40% cut, while Airbus declared a 15% cut. The effect on new deliveries was as follows. In 1991, a total of 821 turbo jets were delivered while 786 were delivered in 1992, a drop of 5%. In 1993 only 685 turbo jets were delivered, a drop of 17% from 1991.*

Shaded areas are meant to show that :
The B707, 727, DC8s, DC9s are fading out of international use and being replaced by the B737, B757, B767, Airbus 320, 340 and MD 80-90s and MD11 freighter. The Douglas DC10 and Lockheed L-1011 are slowly being replaced as from the late 1980s onward by the Airbus A300, A310 and Boeing 767s, while McDonald Douglas production policy aimed at the MD 80s-90s and MD11s.

This massive growth made available huge air capacities on international and domestic routes, and on scheduled and non-scheduled services of world airlines. However, the objective of this section is to show how world airlines became involved with sea-air intermodality as a result of their attempt to capitalise unutilised air capacities on international scheduled routes.

The domestic and unscheduled cargo capacities are dropped from the analysis because:

1. The domestic air cargo capacities that became available were used to move all types of general cargo, including manufactured goods within regions of the same country. In this respect, the domestic movement had hardly any relation to the development of sea-air intermodality. Further, most of the capacity development on the domestic level was centred on passenger traffic. Passengers accounted for an average of 83% by weight of all domestic traffic, while cargo (including mail and express parcels), accounted for an average of 17% for the period between 1969 and 1979, while freight share by weight decreased to 13.0% at the end of 1989, and to 12.5% in 1993, with the general trend on the decline. It should be further noted that most of the world's domestic traffic is developed and performed by two countries. The U.S.A. accounted for 56% and the USSR 24%, with both assuming 80% of world domestic traffic for the same period (1969 - 1979). The share of both countries changed slightly between 1979 and 1989, when the US assumed a share of 57% while the USSR share dropped to 21%. The trend is forecasted to continue until the end of this century, at 60% for the US and 20% for the USSR (now CIS). The source for all the above figures is the ICAO Statistical Yearbook Doc 9180/19, Sept. 1994, and 12/93, A/P1/150.
   As domestic air capacity is 80% dominated by only two countries (USA & USSR), and mostly used for passengers, it has, as such, almost no effect on the world airlines involvement with sea-air intermodality.
2. By the same token, non-scheduled air capacities are operated on request through charter flights and paid for in full, and therefore, do not represent unutilised, and thus non-earning capacities for the air carriers. Non-scheduled operators' share constituted small percentages of the world's total aircraft fleet (Table 3, below).

Table 3. Non-scheduled operators % of world total aircraft fleet

Aircraft Category jet	1969	1974	1979	1984	1989	1993	1994*
Wide-bodied	12.5%	3.6%	4.3%	3.8%	3.3%	2.4%	2.7%
Narrow-bodied	7.0%	8.4%	8.25	8.5%	10.9%	8.5%	8.4%

Source: *Compiled from Table 2 on page 13.*
* *1994 figures forecasted.*

The major emphasis is placed on the international development and growth of air capacities. Table 4, below, shows the increase in the scheduled international air capacities available in Tonne Kilometres (TKAs) for passengers and their luggage, freight and mail, actual tonne kilometre performed (TKPs) by each, and weight load factors showing utilised/unutilised capacities in relation to total tonne kilometres available for international scheduled services, including passenger, baggage, freight and mail.

Table 4. Traffic of World* Commercial Air Carriers international scheduled services (figures in billions - rounded to the nearest 50 million)

Revenue Traffic	1969[1]	1974	1979	1984	1989	1993[2]	1994
Seat Km available	262.0	439.0	681.0	850.0	1203.0	1580.0	1690.0
Pax Load factor	51 %	56 %	63 %	65 %	68 %	66 %	65 %
Tonne Km Performed							
Pax incl. baggage	12.5	22.7	40.2	50.9	76.1	97.0	103.8
Freight	6.1	11.2	18.9	28.9	44.9	55.6	60.3
Mail	1.3	1.2	1.4	1.8	2.1	2.2	2.4
Total	19.9	35.1	60.5	81.6	123.1	154.8	165.7
Tonne Km available	39.5	65.9	102.8	130.9	192.0	251.6	271.8
Weight Load Factor	50 %	53 %	59 %	62 %	64 %	62 %	61 %

Source : *Compiled from ICAO Publications 158-At/57, 222-At/90 and Statistical Yearbook Doc 9180/19, Sept. 1994.*
* *including the CIS.*
1. *1969 figures are estimated, as figures from the USSR were not available for 1969 only, and available from 1970 onward.*
2. *1993 figures are indicative for 1994 forecasted figures.*

The weight load factor in Table 4, above, shows the utilised capacities for passenger, baggage, freight and mail in relation to total capacity available in tonne-kilometres. Therefore the unutilised weight capacity was then available not only for freight, but also for passengers, luggage and mail. What this study is concerned about is the total capacity available for air cargo only.

ICAO, IATA and other international organisations do not calculate, derive or publish any figures relating to freight load factors. In this particular respect of load factors, all these organisations concentrate their efforts on the computation and the publishing of figures relating to 'passenger' load factors and 'weight' load factors, as they probably are still adhering to the old established conception that revenues and profitability of the airline industry depend almost entirely on the passenger load factors. It seems that the carriage of freight and mail is still considered as a small supporting source of revenue and not enough to be worthy of computation and analysis.

For example, ICAO Circular 222-AT/90, computes only passenger and weight load factors in their analysis of the total international movement, including USSR, of passengers, freight and mail, in relation to available international capacities, as follows:

Year	Aircraft kilometres (millions)	Aircraft departures (millions)	Aircraft hours (millions)	Passengers carried (millions)	Passenger kilometres performed (millions)	Seat kms avlbl (millions)	PAX load factor (%)
1984	3,870	2.3	5.7	18.4	555,000	851,000	65

Year	Passengers including baggage (millions)	Tonne-kilometres performed Freight (millions)	Mail (millions)	Total (millions)	Tonne-km available (millions)	Weight load factor (%)
1984	50,970	28,940	1,840	81,750	131,050	62

Source: ICAO Circular 222-AT/90

In 1984, ICAO computed passenger load factors by dividing passenger-km performed by seat-km available, and multiplying the result by 100, to qualify the figure in percentage form, i.e. (555,000 ÷ 851,000) x 100 = 65.2%, rounded to 65%.

While the weight load factor was computed by first converting passengers and their luggage to tonne-kms performed (passenger weight averaged 75 kgs and passenger luggage weight averaged 20 kgs). The resulting figure of 50,970 million TKs performed for passenger and luggage was added to freight and mail TKs performed, to give a total of 81,750 million TKs performed. Dividing 81,750 by 131,050 for total TKs available and multiplying by 100 gives a 'weight' load factor of 62.0%. (81,750 ÷ 131,050) x 100 = 62.4%, rounded to 62%. This weight load factor indicates that 62% of available weight capacities for passengers, cargo and mail was utilised while the remaining 38% of available weight capacities remained unutilised during 1984.

The question that remains pressing and unanswered is: How much of the 38% unutilised weight capacities was available for freight? For the first time ever, in any analysis or research, a freight load factor is derived from the analysis that follows. In order to segregate available space for air cargo from other capacities, the researcher assumed a maximum passenger load factor of 100% and derived weight in TKs that a 100% passenger load factor would perform. Mail TKs were added as actually performed, then both were deducted from total available tonne-kms. The result obtained was the minimum[1] capacity available for freight. Example: ICAO data of 1984, as given on the previous page: If 65% passenger load factor, including baggage, was converted to equal 50,970 million tonne-kms, then 100% passenger load factor, including baggage would equal (50,970 ÷ 65) x 100 = 78,415 million TKs (assumed) performed. Add 78,415 to mail TKs performed of 1,840 = 80,255 million TKs.

1. Minimum capacity available for air cargo is reached at the maximum 100% passenger load factor; as the passenger load factor decreases, weight load capacities for freight and mail increases.

The total capacity available for air cargo was reached by subtracting 80,255 million TKs from the total capacity available for passengers and their luggage, freight and mail, of 131,050 million TKs = 50,795 TKs. Unutilised air cargo capacity was reached by deducting freight TKs performed from the total TKs available for freight, i.e. 50,795 - 28,940 = 21,855 million TKs.

All figures were computed and rounded in billions of TKs, beginning in 1969 up to 1994, in the same manner, and tabulated in Table 5, below, which shows specifically air capacities available for freight (Column 1) and the actual freight performed (Column 2). A freight load factor was derived (Column 4) to show the unutilised air capacities available (Column 3) for air cargo.

Table 5. Development of world[1] derived scheduled international tonne-kilometres (ATKs) for air cargo at 100% assumed PAX load factor and corresponding freight load factors, 1969 - 1994[*] (in billions[2] of TKs)

Year	ATKs (international) for air cargo at 100% Pax load factor Column 1	Freight TKs (international) performed Column 2	Unutilised ATKS (international) Column 3	% Freight Load factors Column 4
1969[3]	13.7	6.1	7.6	44.5
1970	14.0	6.4	7.6	45.7
1971	17.2	7.1	10.1	41.3
1972	19.4	8.3	11.1	42.8
1973	22.3	10.0	12.3	44.8
1974	24.2	11.2	13.0	46.3
1975	26.6	11.6	15.0	43.6
1976	28.9	13.3	15.6	46.0
1977	32.1	15.1	17.0	47.0
1978	34.5	16.9	17.6	49.0
1979	37.6	18.9	18.7	50.3
1980	40.4	20.3	20.1	50.2
1981	43.5	21.7	21.8	49.9
1982	44.2	22.6	21.6	51.1
1983	46.6	25.2	21.4	54.1
1984	50.8	28.9	21.9	56.8
1985	54.8	29.4	25.4	53.6
1986	58.1	32.2	25.9	55.4
1987	64.4	36.7	27.7	57.0
1988	71.5	41.2	30.3	57.6
1989	78.0	44.9	33.1	57.6
1990	84.3	46.3	38.0	54.9
1991	87.1	46.4	40.7	53.3
1992	101.7	50.8	50.9	50.0
1993	102.4	55.6	46.8	54.3
1994[*]	108.0	60.0	48.0	55.5

Source: ICAO Circulars, 158-AT/57, 177-AT/67, 222-AT/90, Doc. - 9180/19, September 1994.

* *1994 figures are forecasted.*

1. *Includes the Commonwealth of Independent States (CIS).*
2. *Figures are rounded to the nearest 50 million ATKs and % points to nearest one tenth of a percentage point.*
3. *1969 figures are based on figures for the same year, in Table 4, page 16.*

In support of the figures, as computed in Table 5, on the previous page, the following exercise is meant to show the validity of assuming a 100% passenger load factor in order to reach realistic figures showing the minimum level of capacities that became available for air cargo every year, starting in 1969.

In 1984, total TKs available on international scheduled services of world airlines' passenger, combi and freighter flights was 131,050 million TKs. Theoretically, the maximum level of air cargo capacities that become available can be shown as an actual 65% passenger load factor by assuming that the balance of total capacities (after deducting that of passenger luggage and mail) becomes available for freight only.

Actual TKs performed, at a 65% passenger load factor, was 50,970 million TKs. Mail TKs performed was 1,840 million TKs. Net TKs assumed to have become available for freight is: 131,050 less 50,970 less 1,840 = 78,240 million TKs.

This means that this figure of 78,240 includes the 35% balance of unutilised passenger and luggage capacity that was available at a 65% passenger load factor, becomes available as additional cargo capacity on the main passenger deck as the passenger under-deck, freighter and combi flights' capacities are already accounted for in the world total TKs available, of 131,050 million TKs.

However, this could hold true only if passenger aircraft were flexible enough to accommodate an increase in freight loading to fill the empty space on board the main passenger deck. In fact, this is not the case. A passenger aircraft takes off on schedule with a 65% passenger load factor, regardless of the freight availability that is able to fill in the balance of available passenger space.

As such, the passenger airline taking off with a 65% passenger load factor is as good as a 100% passenger load factor since the balance of passenger space could not be readily converted into cargo space and, therefore, cannot be considered as increased cargo capacity.

The passenger aircraft main deck is for the exclusive use of passengers, and cannot be utilised for additional cargo in lieu of passengers. Further, bellyholds (underfloor -lower deck- cargo compartments) can be fully loaded with cargo and yet with much less than full passenger occupancy, i.e. passenger aircraft cargo compartments are restricted to maximum cargo loads due to their limited underfloor volume capacity and structural floor tolerance limitation, and therefore these underfloor cargo capacities cannot be expanded to accommodate the additional weights that become available as a result of less than full passenger load.

Having determined the freight load factors and the growth of air cargo capacities over a 25 year period (1969 - 1994), Table 5 page 18, it remains to pinpoint how this growth in cargo capacity was spread over various categories of aircraft, regions and routes, and how the availability of unutilised cargo capacities on certain routes made it possible for the sea-air mode to emerge and grow.

3.2 Distribution of air cargo capacity by aircraft category and type.

Boeing's July 1994 'World Air Cargo Forecast' report states that total world international air cargo capacities made available in 1993, was 203 billion TKAs, while this research defines a figure of 102.4 billion TKAs for freight on scheduled international world services, for the same year (Table 5, page 18).

However, ICAO states that a total of 251.6 billion TKs were available in 1993 for freight, passenger, baggage and mail (Table 4, row 8, on page 16). ICAO converted passenger and luggage, at a 66% passenger load factor, into tonne-km to equal 97.0 billion TKs. Therefore the 'weight' capacity that became available, in 1993, was 251.6 less 97.0 = 154.6 billion TKAs. This weight capacity of 154.6 billion TKs was available not only for freight, but also for passengers (the balance of a 66% PAX load factor), luggage and mail. Therefore, it cannot be considered as exclusively available for freight as analysed and confirmed earlier in the previous section. The figure of 102.4 billion TKs computed by the researcher is most likely to apply for the total world international scheduled air cargo capacities, in 1993.

The discrepancy of 100.4 billion TKAs, between Boeing and the researcher, could be attributed to the following : Boeing used information received directly from airlines. Their market research analysis reflects the addition of Canada and the People's Republic of China. Boeing did not qualify figures relating to total world available cargo capacity. It should have specified inclusion or exclusion of domestic and non-scheduled flight capacities. In addition, Boeing included FSU/Mongolia (i.e countries of the former Soviet Union and Mongolia), in their historical world airline RTKs (Revenue Tonne-Kilometres), which means that the same was included in the computation of TKAs.

Further, many references[1], besides ICAO, were cited in the Boeing foreword note, which means non-ICAO members were also included. As such, Boeing's figure of 203 billion TKA must have included total world available capacity for air cargo without exclusions.

1. Boeing's forward note to its annual Spring report states that all data presented in the report should be considered as estimates based on Boeing analysis. Boeing data was compiled from :
Air Transport Association (ATA)
Association of European Airlines (AEA)
Boeing Foreign Trade Database (TRADE)
International Air Transport Association (IATA)
Data Resources Inc. (DRI)
International Civil Aviation Authority (ICAO)
International Monetary Fund (IMF)
Orient Airline Association (OAA)
US Department of Transportation Form 41 (DOT)
Wharton Economic Forecasting Associates

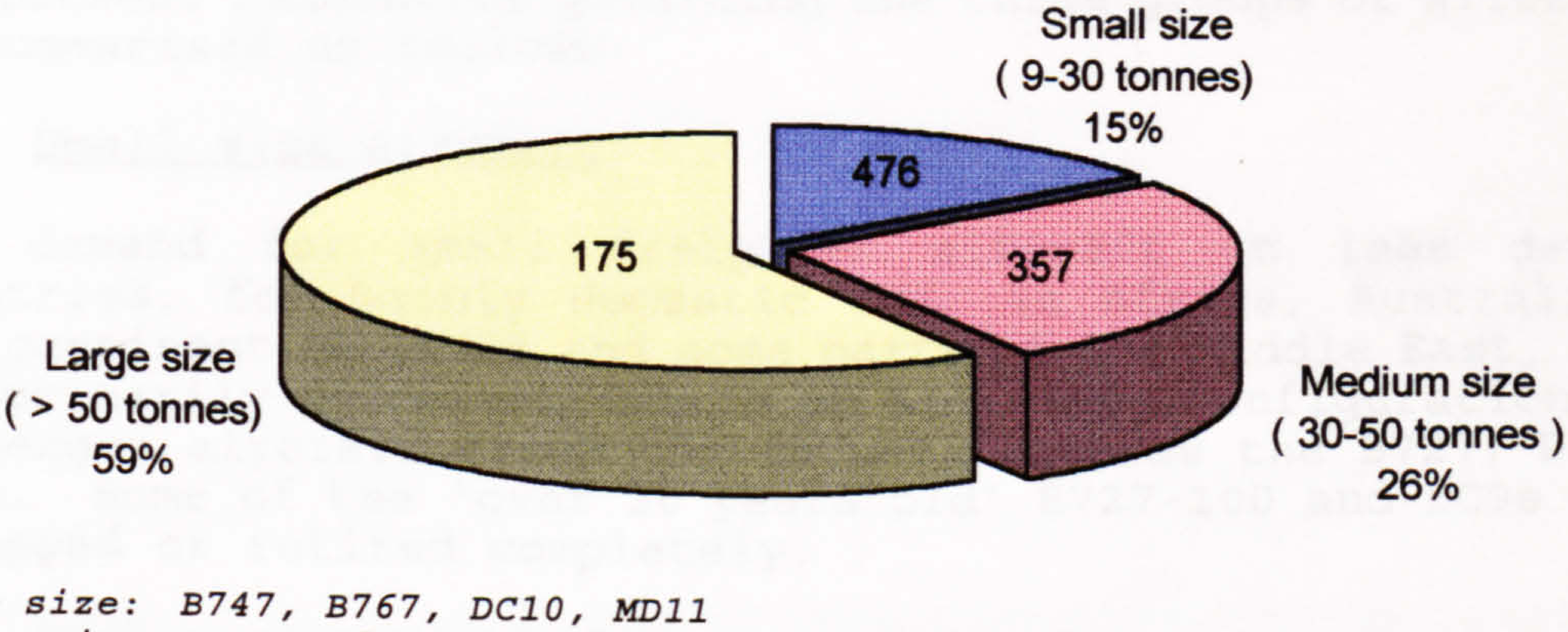
Therefore, the researcher's computation of available cargo capacities on scheduled international services was considered throughout this study, while Boeing's assessment of the spread of these capacities, by type of aircraft, was accepted. In 1993, the shares were as follows:

Passenger aircraft share	:	51%
Freighter aircraft share	:	42%
Combi (PAX + freight)	:	7%

According to Boeing's 1994 report, the world freighter fleet showed a dramatic increase over the 25 year period under analysis - from 'slightly over 100' aircraft in 1969 to 1,008 in 1993. An addition of 120 freighter aircraft in 1994 is expected. As for the air cargo capacity provided by the then jet freighter fleet of B707s and DC8s aircraft, it showed an impressive increase from just under 6 billion ATKs in 1969 to 86 billion ATKs in 1993, and an anticipated 91 billion ATKs in 1994 (average 6% increase p.a.). Growth of world cargo capacity was averaged at 5.7% per annum. Compared with 1992 figures, 1993 shows more than a 16% increase in world air cargo capacity, while the freighter fleet share of world air cargo capacity showed a negative figure of 2% less than 1992, as only 85 freighters were added to the world fleet in 1993. This simply means that the world passenger fleet was the main provider of the 16% increase in world air cargo capacities.

Boeing's classification of world freighter aircraft and their percentage share of world freighter fleet capacity, by type of aircraft, is shown in Figure 1, below, while Table 6, on the following page, shows, in particular, the percentage distribution of world passenger and freighter aircraft by category, and their percentage share of world total cargo capacity.

Figure 1. Freighter share of world available cargo capacity (1993)



Large size: B747, B767, DC10, MD11
Medium size: B707, DC8, A300/310, L-1011, B757
Small size: B727, B737, DC9 - MD80, BAe-146 Caravelle.
Figures in the coloured segments refer to all freighter aircraft of different sizes (derived from Table 6 on the following page).

Table 6. Distribution of available world air cargo capacity between freighter/passenger services (1993)

100% world aircraft's cargo capacities		Freighter capacity share 42% of world total		Pax & Combi share 58% of world total capacity			
	1	2	3	4	5	6	7	4 + 7
Boeing Classification of world aircraft by cargo capacity	Total No. of World Aircraft	Total No. of world freighters	% share of freight capacity	% of total world aircraft	Total Pax and Combi aircraft	% share of freighter capacity	% of total world aircraft	% share of total world Aircraft
<u>Small</u> B727 - 1300 DC9 - 400 MD80 - 1139 B737 - 2540 BAe146- 245 Others- 700	6,324	476	15%	7.5%	5,848	7.0%	92.5	100%
<u>Medium</u> B707 - 145 DC8 - 120 A300 - 430 A310 - 280 L1011- 200 B757 - 540	1,715	357	26%	21%	1,358	18.0%	79%	100%
<u>Large</u> B747 - 1040 B767 - 590 DC10 - 330 MD11 - 150	2,110	175	59%	8%	1,935	75%	92%	100%
Total	**10,149**	**1,008**	**100%**	-	**9,141**	**100%**	-	**100%**

Source: *Compiled from Boeing's July 1994 World Air Cargo Forecasts and ICAO Doc 9180/19, Statistical Yearbook, 1993, issued Sept. 1994. Column 7 is compiled and computed by the researcher.*

The present tendencies governing the three groups of aircraft can be summarised as follows:

1. <u>Small size aircraft</u>:

The demand for small freighter aircraft in less developed countries, for mainly domestic use, in Africa, Australia, the sub-continent of India and some parts of the Middle East, will be met primarily by conversion to an all-cargo configuration of the passenger aircraft presently in use, such as the B727, B737 and DC9s. Some of the 'over 20 years old' B727-100 and DC9s will be scrapped or retired completely.

2. <u>Medium size aircraft</u> :

This category will continue to grow, especially in response to a growing demand by the integrators, courier operators, and medium size freight operators. The old B707 and DC8s presently dominate the scene in this category. However, the world fleet is shifting towards a mix of DC8s and many new freighter versions of B757 and B767 aircraft. As for the future of the B707 and the DC8s, compliance with Stage 3 noise limitations will start the elimination process of most of the over 20 year old aircraft. Approximately 280 of them are at present in operation. It is expected that by the year 2000, as a result of strict enforcement of Stage 3 noise limits, the majority of these aircraft will be barred from use in North American, European and Pacific Basin countries. Many will be diverted for use in South America, Africa, the Indian sub-continent, Australia and the Middle East.

Regardless of this diversion, the operators of these 20 year old aircraft must be able to balance their requirement for survival, such as:

1. The relatively high cost of heavy-duty maintenance.
2. High fuel consumption per block hour.
3. The high cost of overhauling engines, and in most cases the complete replacement of engines, against the acquisition of new aircraft, though with much higher capital outlay, but rendering : a) low maintenance costs and b) high fuel efficiency, low fuel consumption per block hour, (approximately 22% less than older generation aircraft).

The pressure to replace old aircraft will continue growing and pressing operators with Stage 3 noise compliance, and the consequential high cost of hush-kitting until such time as the old aircraft become a burden to its users, regardless of the development status of the country of use.

3. <u>Large size aircraft</u>:

The emergence of long range wide-bodied aircraft, such as the Airbus 340, B777, B747-400 and the MD-11, as replacements for the L-1011 and DC10s, and B747-100/200/300, is attributed largely to the passenger factor, or air travel demand. New Large Aircraft (NLA) are emerging in response to the pressing demand for :

a. lower fares.
b. more non-stop long range flights.
c. higher frequency of services.

What concerns this research are the potential huge air cargo capacities that are bound to materialise as a result of conversion to an all-cargo configuration of a good portion of wide-bodied aircraft presently in use for mainly passenger traffic. This means that more air cargo capacities will become available for the sea-air and direct air freight modes.

Therefore, a brief analysis of this trend becomes relevant to the research. Having defined the air travel quest, the second step is to define how the airline industry is responding; what are they demanding from the aircraft industry?

Despite the airline recession and the Arab Gulf War, British Airways formed a 'New Large Aircraft' (NLA) project group in 1991, simply because it was convinced that the B747-400 is too small to satisfy its long term needs. Its requirements call for a 600 - 900 seat aircraft to be ready by the year 2002. British Airways expect this aircraft to weigh 500 tonnes, and have a tail as big as the 757 wing, and be able to fly London to Singapore non-stop with full passenger and luggage loads, plus 10 tonnes of cargo. British Airways wants this aircraft to match 6% average passenger growth per year and allow the airline to compete in key long range intercontinental markets such as the Pacific Rim countries.

Operating and Manufacturing costs: are emphasised as a major concern to the group. Targets were defined to the aircraft manufacturers with a focus on :

1. Maintenance costs should be minimal during the first ten years of aircraft use. Longer service times, at lower costs than at present applied, should be provided by the manufacturers.

2. Fuel efficiency, i.e. lower fuel consumption per PAX mile.

3. Usability at current airports and the possibility of reducing the present turnround time of the B747 of 105 minutes to 90 minutes for the 'NLA'.

4. Reduction of airframe noise to meet stricter requirements of Chapter 4 noise standards, over the present 3 - 4 dB noise standard.

5. The possibility of deleting corrosion inspection during the entire life of the aircraft.

6. Reduction of overall operating costs by 20% of its present level.

7. Acquisition cost: initial capital outlay to the bare minimum acceptable to financing entities with prolonged payment schedules.

In short, the group's emphasis focused on reduced maintenance costs, and a greater degree of reliability and durability, rather than innovations in the cockpit and aircraft systems.

Boeing highlights the unprecedented advantage of route planning flexibility for the new generation aircraft. It places a heavy focus on the Pacific Rim destinations :

1. New direct international flights to the West Coast of North America, from Europe and Asia.

2. New direct domestic flights within Japan, China and the USA.

Boeing, Airbus and McDonnell Douglas Industries are still very cautious about the NLA. Airbus Managing Director, Mr. Jean Pierson, and Boeing President, Mr. Ron Woodward have both stated recently (Aviation Week, Nov 21, 1994), that airline executives are still too focused on the recent recession to decide on the size of the forthcoming aircraft. Despite this caution, ICAO forecasts orders for the New Large Aircraft to surpass 800 by the year 2015.

ICAO forecasts for the year 2015 are as follows :

Table 7: **World Passenger aircraft**
vis-á-vis seating capacity
(forecast for the year 2015)

Small size new aircraft No. of seats	No. of aircraft	Large size new aircraft No. of seats	No. of aircraft
81 - 150	7975	301 - 400	2301
151 - 210	3450	401 - 600	443
211 - 300	3238	601 & over	360
Total	**14,663**		**3,104**

Source : Compiled from ICAO Doc. 9180/19

Having pinpointed the future trend of the world passenger and freighter fleets and anticipated their cargo capacities in general, an important aspect of the study remains to be determined, and that is the cargo capacities available on both passenger and all freighter scheduled international services, and their relative distribution by region on major routes, in order to trace the development and growth of sea-air intermodality.

Table 6, page 22, shows the Boeing 1994 spread of the percentage shares of world cargo capacities over three categories of aircraft, classified according to their use as passengers, including combis and freighters. Boeing classification by cargo capacity of each category of aircraft can be adjusted to comply with the ICAO classification of two main categories, wide and narrow bodied aircraft, instead of Boeing's three (small, medium and large).

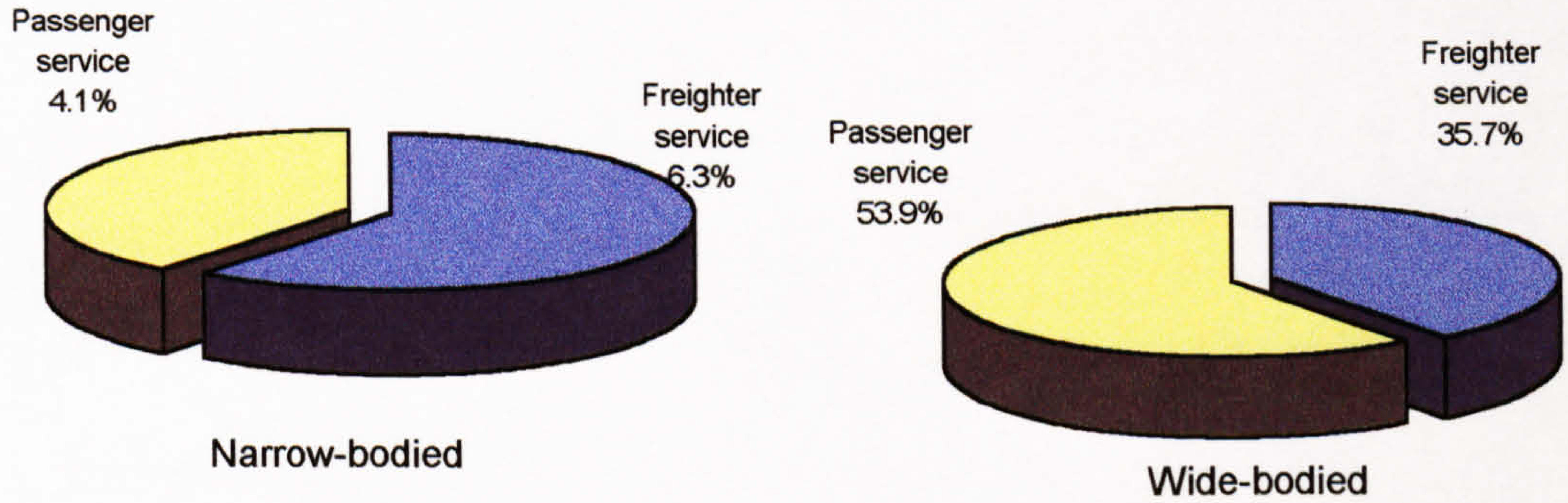
The Boeing small category can all fit in the ICAO narrow-bodied category, while medium and large aircraft can fit in ICAO wide-bodied aircraft categories with the exception of three types, the B707, the DC8 and the B757; which as passenger aircraft are dropped from Boeing's classification and included in the ICAO narrow-bodied category, but once converted to all freighter configuration, and in terms of cargo capacity that they are able to provide, are upgraded to ICAO's wide-bodied category.

As per Boeing's Figure 1, page 21, large and medium size freighters assume 59% and 26% respectively, of world freighter fleet capacity, i.e. 85% for both, while the small (narrow-bodied) freighters assumed only 15% of the available world air cargo capacity.

World freighter fleet capacity share is 42% of the world total fleet capacity, including passengers and combis, whose share is the balance of 58% (Table 6, page 22). Considering that both medium and large-size aircraft fall under ICAO wide-bodied category, then the world freighter wide-bodied aircraft share is: 85% x 42% = 35.7% of world air cargo capacity (Figure 2, below).

As for scheduled passenger services, including combis, ICAO wide-bodied passenger aircraft provide 93% (18%+75%, Table 6, page 22) of cargo capacities available on international passenger scheduled services. Therefore, wide-bodied aircraft provide: 93% x 58% = 53.9% as total passenger wide-bodied aircraft share of international cargo capacity. Therefore, wide-bodied aircraft passenger and cargo flights, provide 53.9% + 35.7% = 89.6% of total international cargo capacities.

Figure 2. Distribution of available world *cargo capacities between freighter and passenger services, by ICAO category of aircraft*



Source: Compiled from Boeing's July 1994 air cargo forecasts, and the ICAO 9180/19 statistical yearbook, 1993 & Sept. 1994 issue, and our work sheets.

It should be noted here that the impact of wide-bodied aircraft was not only felt in the increased cargo capacities that became available, but also, and more so, in the increase of actual freight tonne performed. Before 1969[1], freight represented only 19.0% of the total international weight traffic, while passengers by weight, luggage and mail accounted for 81%. The international freight weight share grew to 31.2% in 1974 and an estimated 36.6% in 1994 (Table 8, on the following page).

1. In 1968, the total international traffic as per ICAO was 18.7 billion TKPs, while the freight share was 3.6 billion TKPs.

Table 8. Total international traffic
and freight share
(in billions of TKs performed)

	1969	1974	1979	1984	1989	1993[1]*	1994**
Total intl. traffic (PAX+baggage+mail+freight)	19.5	35.1	60.6	81.7	123.1	154.8	164.8
Freight	6.1	11.2	18.9	28.9	44.9	55.6	60.3
% share	31.0%	32.0%	31.2%	35.4%	36.5%	36.0%	36.6%

Source: Compiled from ICAO Circulars 158-AT/57, 1980, 222-AT/90 1989, 244-AT/99, 1993 and 250-AT/102, 1994.
1. Includes CIS countries
** 1993 figures are indicative for deriving 1994 figures.*
*** 1994 figures are forecasted.*

How did this development take place? Which regions of the world were relatively more active in generating this increase in international freight movement? To what degree, and why? What are the routes that showed dense activity in freight movement, and why? To answer these questions, a review of the world fleet distribution by category of aircraft, and the regions acquiring and operating them, becomes relevant to this study. The objective is to trace the development of air cargo capacities on international major routes connecting the six main regions of the world.

While accepting the fact that the increase in air cargo capacity came in response to growing demand, the supply of freight capacities came in much larger volumes than the ability of demand to cope. Table 5, page 18, shows that unutilised available capacity was 55.5% of total available freight capacity in 1969. This percentage declined to 42.4% in 1989 and rose to 45.7% in 1993, with an expected 44.5% in 1994. It remains to be determined on what routes the over-supply of capacities was available, and how the principle of 'supply creates its own demand' provided the necessary fertile ground for the emergence of sea-air intermodality.

3.3 Distribution of air cargo capacities by region:

The most important development in the world commercial fleet that took place between 1969 and 1994, was the growth of wide-bodied aircraft which reflects almost 90% (Figure 2, page 26) of world cargo capacities available in 1994. Appendix A[1] and Figures 3 and 4, on the next two pages, trace the development and growth of the jet fleets of the six main regions of the world, by category of aircraft, wide and narrow bodied, and the percentage variation of each region's fleet with the rest of the world over a period of 25 years, in 5 year growth intervals.

1. Appendix 1 shows accurate figures of distribution by region of aircraft categories.

Figure 3 : Distribution by region of aircraft categories (wide - bodied) of world air transport fleet and percentage of regional share

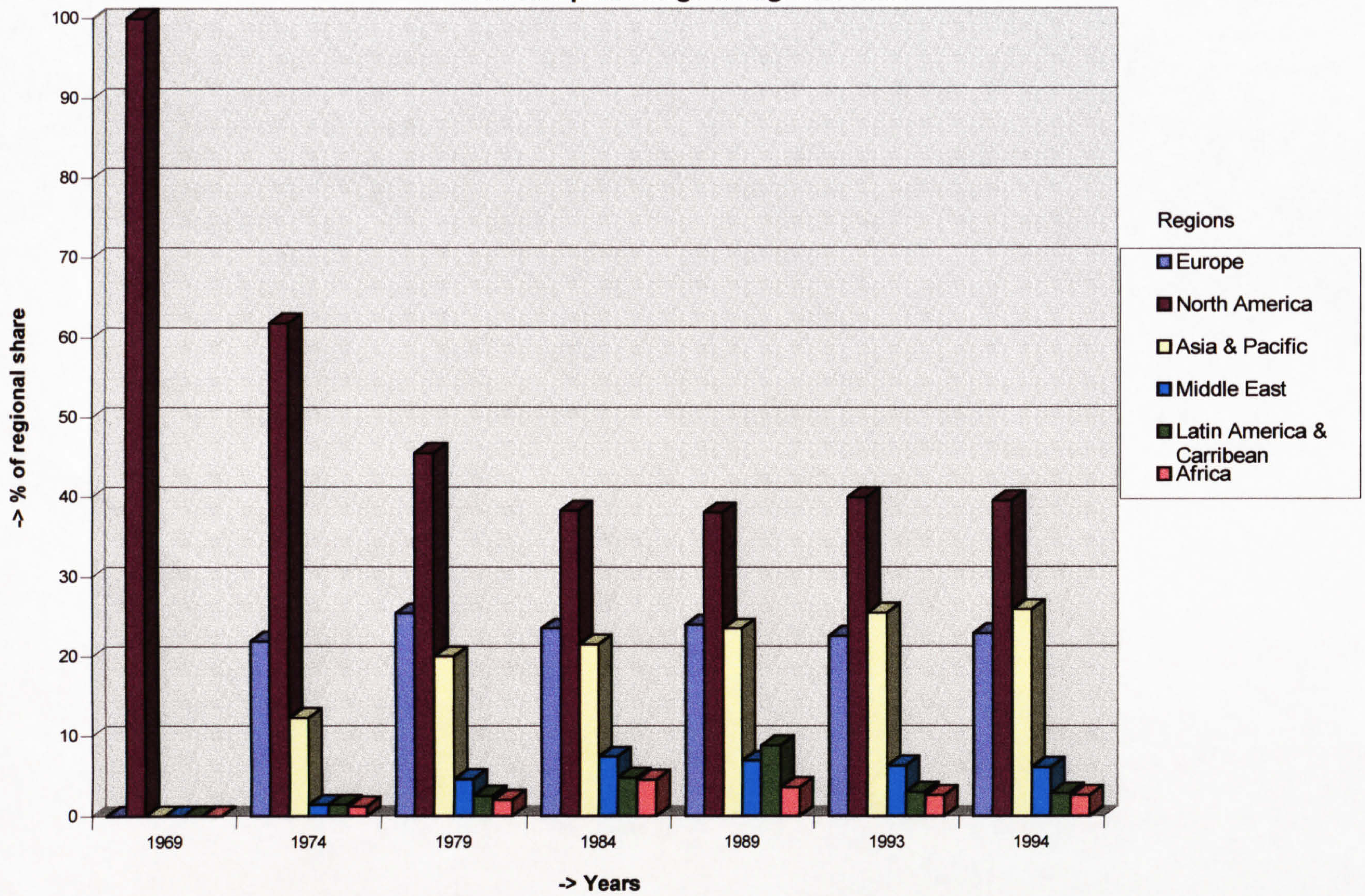
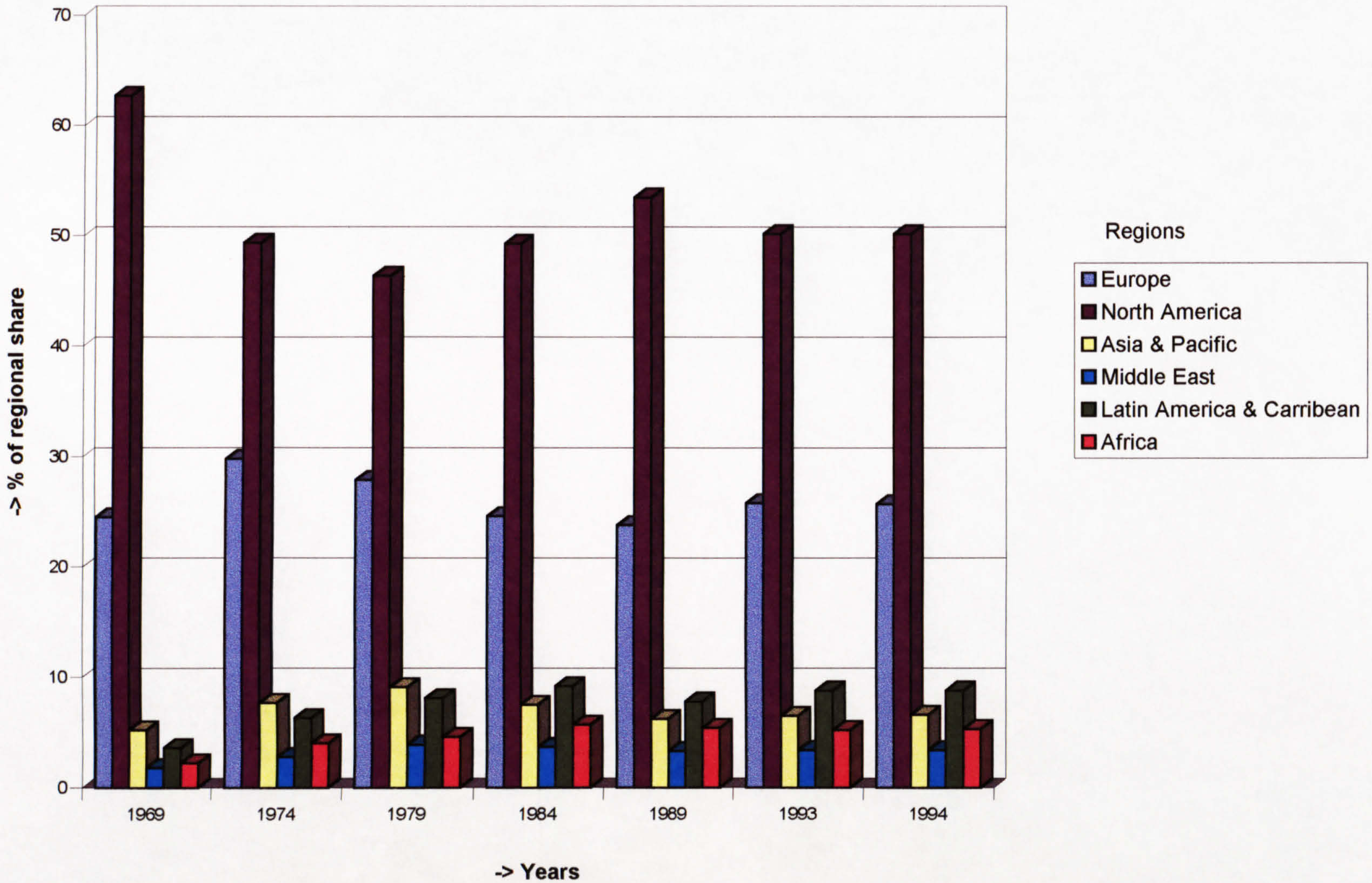


Figure 4 : Distribution by region of aircraft categories (narrow-bodied) of world air transport fleet and percentage of regional share



In 1969, the wide-bodied jets were the exclusive property of North American carriers, as they then owned 100% of the total in world service. By 1974, this share dropped to 62.7% while that of Europe shot up to 21.9%, with both regions assuming 84.6% of the world wide-bodied fleet, and, therefore, providing 75.8% (computed by multiplying 84.6% world wide-bodied fleet by 89.6%, world international cargo capacity provided by wide-bodied jets) of international air cargo capacity.

Before 1974, international scheduled air cargo capacities were provided by mainly the world freighter fleet services, then in operation, which consisted largely of B707s, DC8s, B727s, DC10s, L-1011 and very few B747 freighters, and to a much smaller extent by the very few scheduled international combi flights operated by a handful of airlines such as KLM, Air France and Swiss Air, and finally by the lower deck cargo compartments of international scheduled passenger services. Therefore, a meaningful spread of air cargo capacity between wide and narrow-bodied aircraft should start with 1974, allowing a few years from the first year of entry into world service, for progressive absorption of the then new technology aircraft into the world fleet. The new technology aircraft were:

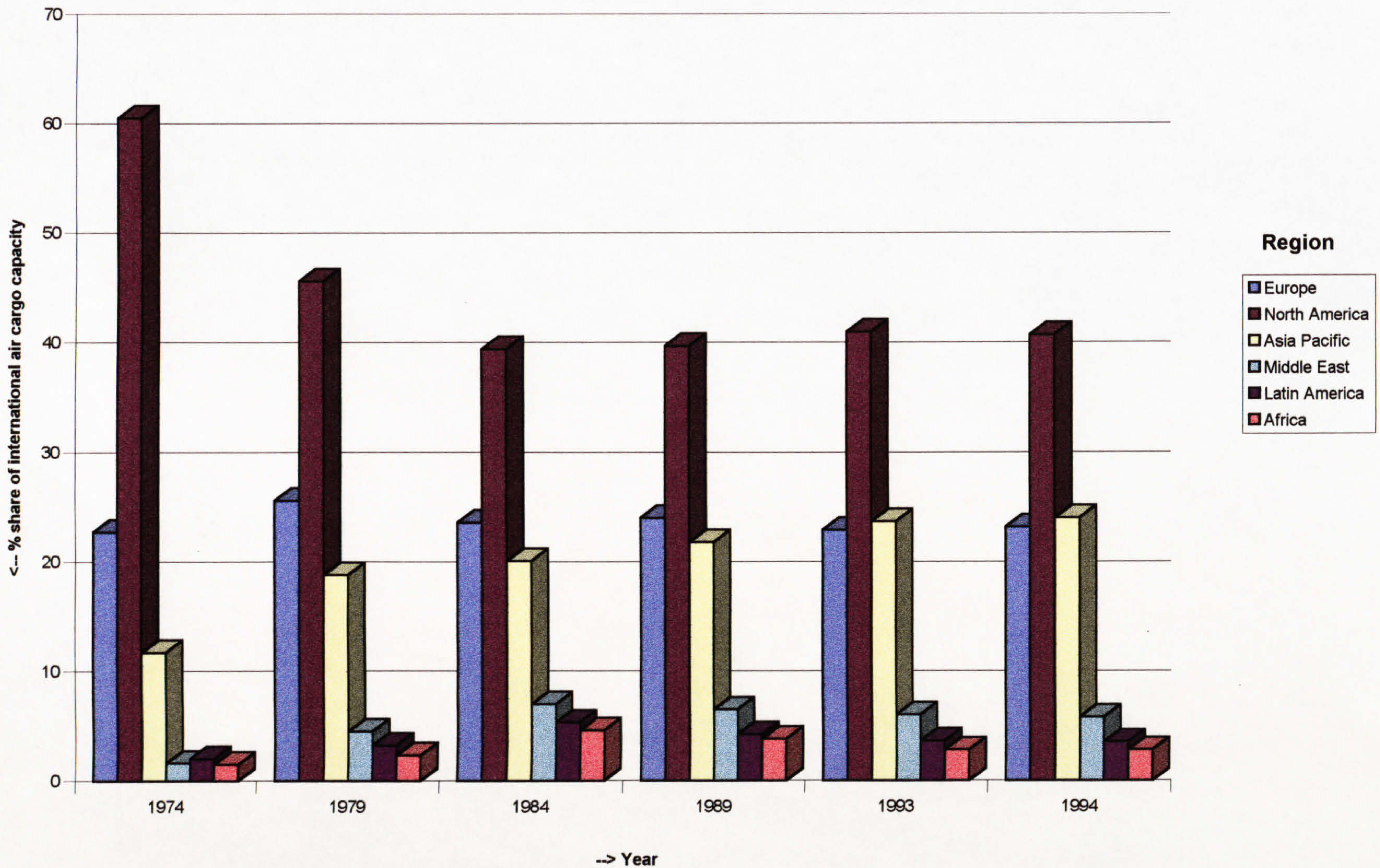
B737 first entry in 1967
B747 first entry in 1969
DC10 first entry in 1971
L-1011 first entry in 1972
A300 first entry in 1974

By the year 1979, the dominance of North America and Europe was challenged by the newly emerging giant of the Asia-Pacific region, whose wide-bodied fleet share of the world total, grew from zero in 1969 to 12.3% in 1974 and 20% in 1979, while that of Europe and North America declined to 25.4% and 45.5% respectively. As a result, three regions dominated 90.9% of the world wide-bodied fleet. The increase in the number of wide-bodied aircraft from 16 in 1969 to 503 in 1974 and 932 in 1979 was mainly responsible for the huge air cargo capacities that became available on international services.

Despite the fact that this decade (1969 - 1979) was depressed by two periods of fuel price increases, 1974 and 1979, and two world wide recessions, which led to a slump in economic activities, nevertheless, the growth in air cargo capacities continued unabated through the second decade under review (1979 - 1989), with a high rate of acquisition of wide-bodied aircraft, especially by the Asia Pacific region, which almost equalled Europe in 1984 by acquiring 320 wide-bodied aircraft against 350 for Europe. By 1989, the Asia Pacific region was almost on a par with Europe, both assuming respectively, 23.5% and 24% of the world wide-bodied fleet.

For the last 5 year interval under analysis (1989 - 1994), the Asia Pacific region continued its pace of wide-bodied aircraft acquisition, and by 1993 its share grew to 25.5% against 22.6% for Europe and 40% for North America. Estimates for 1994 place.

Figure 5 : Regional Percentage share distribution of International air cargo capacity (1974 - 1994)



Europe at 22.9%, North America at 39.6% and the Asia Pacific region at 25.9% (Figures 3 and 4, pages 28 and 29 and Appendix A). These three regions of the world actually dominate the world wide-bodied fleet share with a total of 88.4% between them.

Given that 89.6% of international cargo capacity is provided by the world wide-bodied fleet (Figure 2, page 26), therefore, as these three regions together assume 88.4% of world wide-bodied fleet, they provided 79.2% (89.6 x 88.4) of total available international air cargo capacity in 1994.

The percentage share of each region of international air cargo capacities (Figure 5, page 31 and Appendix B) was computed based on findings in Figure 2, page 26 and Appendix A. Each region's percentage share of the world total fleet of wide and narrow-bodied aircraft was multiplied by the relative percentage capacity that each type of aircraft provides.

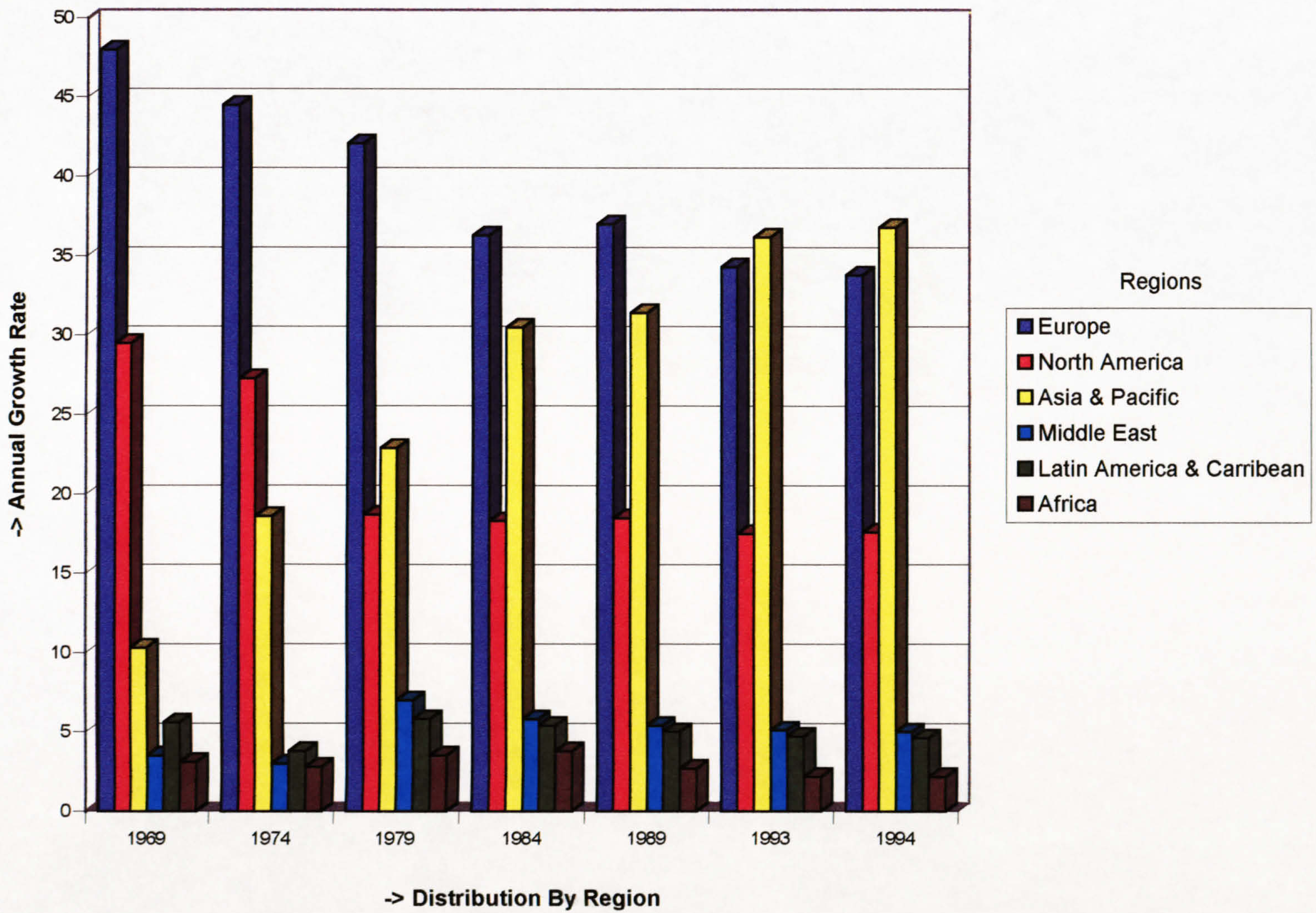
Example: In 1993, Europe's share of the world wide-bodied aircraft fleet was 22.6% (Appendix A). Wide-bodied aircraft provided 89.6% of world air cargo capacity (Figure 2, page 26), therefore Europe's wide-bodied aircraft cargo capacity was 22.6% x 89.6% = 20.2%. While its narrow-bodied cargo capacity is its share of world narrow bodied total fleet of 25.8% (Appendix A) multiplied by the cargo capacity of 10.4% (Figure 2), which equals 2.7%.

As the spread of wide-bodied aircraft among world regions materialised gradually and took form in the 1970s, therefore, a realistic spread of world capacities should start with 1974. A percentage share of available international cargo capacity for each region was computed as per the example above, and tabulated in Appendix B.

3.4 Regional development of air cargo traffic:

In 1969, Europe alone was the most dominant region in the carriage of freight traffic, as it controlled 48.0% of the total world international air cargo movement. The second region was North America, with control of 29.5% of the world total. Both regions carried 77.5% of the world international cargo (Figure 6 on the following page and Appendix C). By 1979, Europe's share dropped to 42.1% and that of North America to 18.7%, giving way to the powerful emergence of the Asia Pacific region, claiming 22.9% of the world total, as against a mere 10.3% in 1969. The Asia Pacific region airlines grew exceptionally well during the first decade of review. They were able to penetrate the international freight market rather rapidly, achieving an annual growth rate of 21.1%, much higher than the world average annual growth rate of 12.1% for that period.

Figure 6 : Percentage distribution of international scheduled air cargo traffic in millions TKs performed by region



'As a result, there has been a fundamental restructuring of the international air freight industry, with the centre of gravity shifting towards Asia and the Pacific. As a group, the Asian and Pacific carriers overtook North American airlines in the carriage of international freight by the end of the 1970s, and they are now in the process of rapidly overtaking their European counterparts as well'.[1]

The Asia Pacific region's annual growth rate of 13.8% between 1979 and 1989 gave it a share of 31.4% of international air cargo traffic against only 18.5% for North American carriers, while Europe maintained a good share by capturing 37.0%, with an annual growth rate of only 7.7%, well below the world average of 9.2%. By 1993, the Asia Pacific region overtook Europe and assumed 36.2% of world international air cargo traffic, against 34.3% for Europe and 17.5% for North American carriers. The trend is expected to continue through 1994 with the Asia Pacific region assuming approximately 37.0% of the world international freight market, with about 34% for Europe and 17.6% for North America.

Many developments took place in the airline industry, and specifically that of Europe and North America, between 1969 - 1994, which helped the Asia Pacific carriers to penetrate deep into the international air cargo traffic market, developing a trend of increasing involvement which is expected to continue until the end of the century. ICAO forecasts the Asia Pacific region to be in control of approximately 42% of the international air cargo traffic by the year 2003 (ICAO Circular PIO 10-94).

The phenomenal growth rate of airlines of the Asia Pacific region was supported indirectly by a relative decline in interest by the North American and European carriers on two major route groups; the North Atlantic and the intra-European.

Table 9. Percentage of world international scheduled air cargo traffic on the North Atlantic & Intra-European route groups

	1969	1974	1979	1984	1989	1994[1]
<u>North Atlantic</u>						
Freight tonne-km	42.0%	38.0%	23.0%	25.3%	27.0%	25.6%
Annual growth rate			5.5%		7.0%	
<u>Intra European</u>						
Freight tonne-km	7.0%	-	4.0%	-	2.8%	-
Annual growth rate	-	-	7.5%	-	5.5%	-

Source: *Compiled, computed and tabulated from ICAO Circular 158 - AT/57, 222 AT/90, 237-AT/96 and Doc 9180/19, and World Air Transport statistics No. 38 Wats 6/94.*

1. *1994 figures are forecasted.*

1. Doganis, Rigas (1991), 'Flying Off Course', pages 316 - 317, second edition reprinted in 1992 by Routledge, 11 New Fetter lane, London.

1. The North Atlantic route group suffered most as they lost 19% of their share of total international air cargo traffic, dropping from 42% to 23%, between 1969 and 1979 (Table 9 on page 34). However, a small part of this loss, that of 4%, was regained by 1989 to reach 27%. This share is expected to decline again to 25% by 1994.

The sharp decline in interest on this route group was largely due to the highly de-regulated market of the North American region, a fact that accelerated the growth of unscheduled services, and at the same time opened the doors for the immediate entry of the Asia-Pacific region's carriers.

In 1969, the non-scheduled share was 26.2% of total passengers and cargo carried, and grew to its highest ever of 29.3% in 1971 and started dropping gradually to 24.6% in 1974, and to approximately 14.8% in 1979. The declining trend continued through the 1980s claiming 12.1% in 1984, and fluctuated between 7% and 10% for the rest of the period, stabilising at 7.0% in 1989. In 1993, the share of non-scheduled services on this route group grew to 10.5% and is expected not to exceed 11.0% in 1994.

The decline in non-scheduled services came about as a result of a shift of focus to domestic services, which took place in response to pressing regional requirements to provide regular non-stop services to many North American city-pair markets, too small to be serviced by large wide-bodied passenger aircraft. This particular development was mainly responsible for the increased orders for smaller, narrow-bodied aircraft within the 75 - 150 seats range. As such, belly-hold cargo capacities on these aircraft were of no significance to regional and international air cargo movement.

However, this was followed by an increase in demand for narrow-bodied cargo aircraft, by the newly emerging 'parcel express airlines', firstly in North America and secondly in Europe. These new airlines grew fast, and by 1989 they operated a huge fleet of narrow-bodied cargo jets providing overnight deliveries within their region, and second day inter-continental deliveries via strategically located sorting hubs.

North America's narrow-bodied aircraft fleet grew from 46.4% in 1979 to 53.5% in 1989, and an expected 50.2% in 1994, while that of Europe grew by 12%, assuming 27.9% in 1979 and 23.8% in 1989, and is expected to assume a share of 25.7% in 1994 (Appendix A).

2. The intra-European route groups suffered as well. Their share of intra-European cargo traffic, considered international on the European level, dropped almost 43% from 7% in 1969 to 4% in 1979. The downward trend continued, to reach 2.8% in 1989. This development was mainly due to two major factors:

a. The European non-scheduled services had a relatively larger slice of this market. Their share almost doubled by 1979 and assumed 40% of the total traffic carried, with a growing trend that claimed 42% in 1984, and reached its peak of 50.3% in 1989. The period between 1989 and 1992 was characterised by the Arab Gulf crisis and fuel price increases, whereby economic development, especially that of the airline industry, was stagnant, operating at almost the break-even point, or even making losses. As a result, there was a shift of emphasis of the scheduled European carriers to their own domestic market. From then onward, a declining trend started to take shape as the growth of unscheduled services was checked. The non-scheduled services' share of the market had a very sharp drop to less than 1% of the total European domestic traffic, and in 1993 assumed a humble share of only 3%. By 1992, the domestic charter operators had almost disappeared from the European market.

b. The growth and reliability of the European overland transport system witnessed great improvements in the motorways and railway networks. Therefore, starting in 1974, there began a gradual shift to overland transport in the handling procedures of international air cargo traffic arriving or departing major European gateways. As distances between major European cities are relatively short, many European airlines started an overland freight interchange facility of their own, a trucking hub, for their regional distribution of international cargo imports to any point in Europe, and at the same time, serving their international cargo exports to any point in the world.

The system operates as follows: Exports are handled through the pick up of any shipment from any point in Europe by truck to the interchange facility where the shipment is sorted, labelled, marked and numbered and built into a relevant container ready for onward carriage, regionally by truck to its destination, and internationally by truck, from the interchange facility to the international exit gateway airport for immediate uplift to its final destination on a pre-booked international flight.

Cargo imports are handled through the pick-up, by truck, of shipments as they are offloaded from arriving international scheduled flights into Europe's major entry gateway airports, to the interchange facility or the trucking hub of the relevant airline, where further distribution by truck, to any point in Europe (as final destination), takes place on scheduled and numbered trips. British Airways operates a European trucking inter-change hub at Maastricht, KLM at Amsterdam and Ghotenburg, Lufthansa at Frankfurt. Many other freighter airlines use Ostend, Amsterdam and Brussels as their interchange point.

The Asia-Pacific carriers either took advantage of the already established European trucking hubs, by using them in agreement with the European airlines operating them; such as China Airlines using the trucking system of Cargolux at Luxembourg, or by establishing their own trucking hub; as did Singapore Airlines and Cathay Pacific, using their own fleet of trucks, the first from/to Amsterdam, Brussels, Frankfurt and Manchester, and the latter from/to Frankfurt, for further inland distribution and collection of their cargoes. Some Asia-Pacific airlines use both, i.e. the European trucking system and their own, such as Air Hong Kong, an entirely wide-bodied freighter airline, which maintains regular frequencies into Manchester and Brussels, uses its own trucking fleet from/to Manchester, and the Sabena trucking system from/to Brussels Airport.

3. Other factors which helped the growth of the Asia Pacific region were partly due to a change in demand patterns by the European and North American consumers. The demand increased, for manufactured goods produced in the Asia Pacific region, though they were supplied in the early 1970s at a lower degree of quality, as compared with similar commodities produced in Europe and North America, but at a much lower price in the market place. Gradually, Asia Pacific's improved quality products replaced a large part of the European and North American products in the market place of both.

The implications of this analysis are clear. The European and North American carriers' greater involvement with their own domestic services, left much ground to be explored and invaded by other regions of the world, led by the Asia Pacific region.

The productivity of each of the world's six regions must be analysed in relation to their share of available international cargo capacities vis-á-vis actual freight performance in terms of tonne-kilometres, in order to derive relevant freight load factors and identify regions and routes where unutilised cargo capacities become available, and therefore present the possibilities of sea-air intermodality to step in.

As seen in Figures 7 and 8 on the next two pages, and as tabulated in Appendix D, the lowest freight load factor falls in the region of North America, providing the highest unutilised cargo capacity at an average of 75%, followed by the Middle East and Africa, with over 50% unutilised cargo capacities each. The regions with the highest freight load factor, and therefore the lowest unutilised capacity are those of the Asia-Pacific region, Europe and Latin America and the Caribbean.

The question is, on what route groups is sea-air intermodality most likely to develop? Route groups between regions provide a scheduled network of international services, connecting at least two of the six regions of the world with each other, while route groups within a region provide connections among the countries of that region. Route groups between regions are serviced by large wide-bodied aircraft, while route groups within a region are mostly served by narrow-bodied ones.

Figure 7 : Freight load factors by region (TKs in billions, 1974 - 1994)

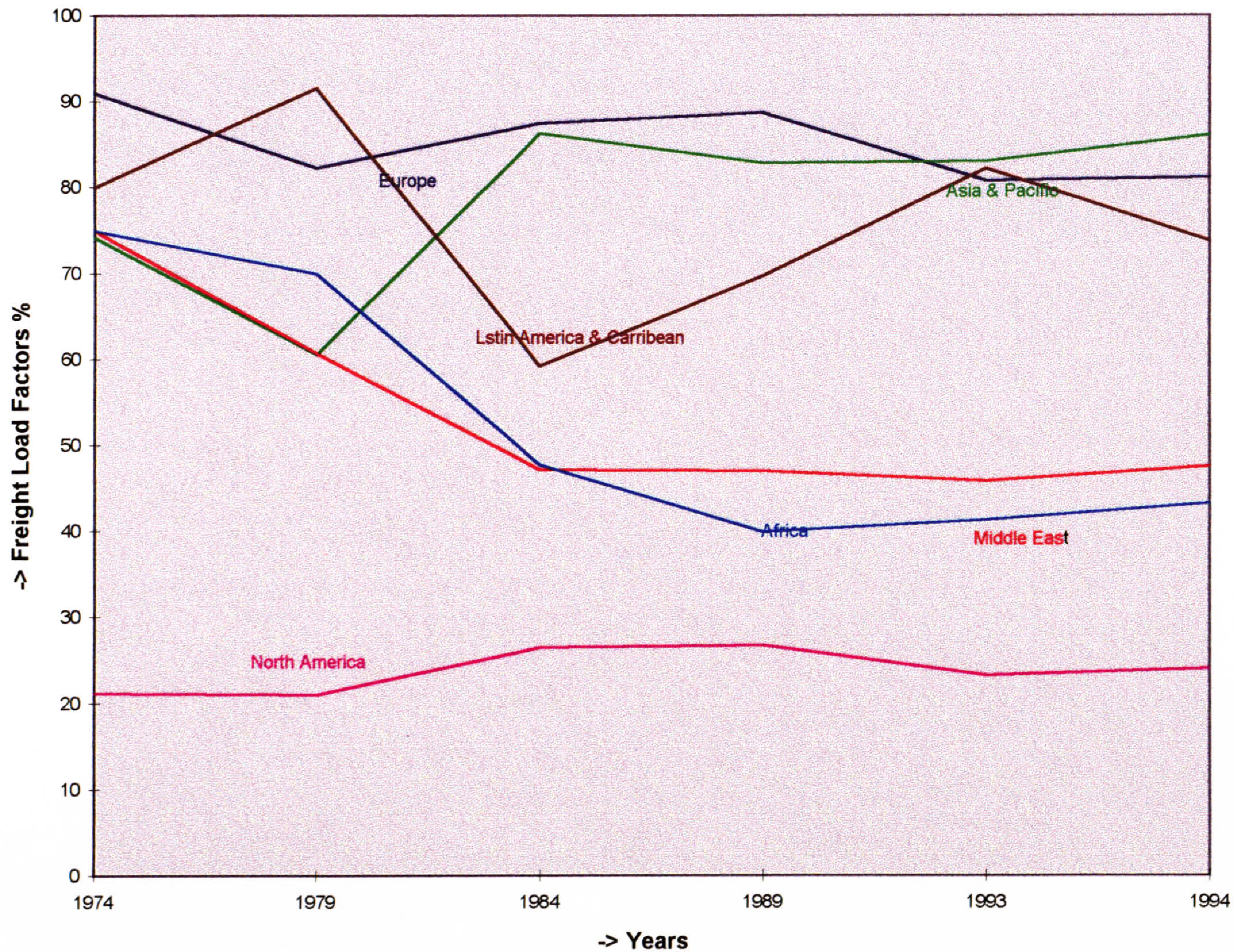
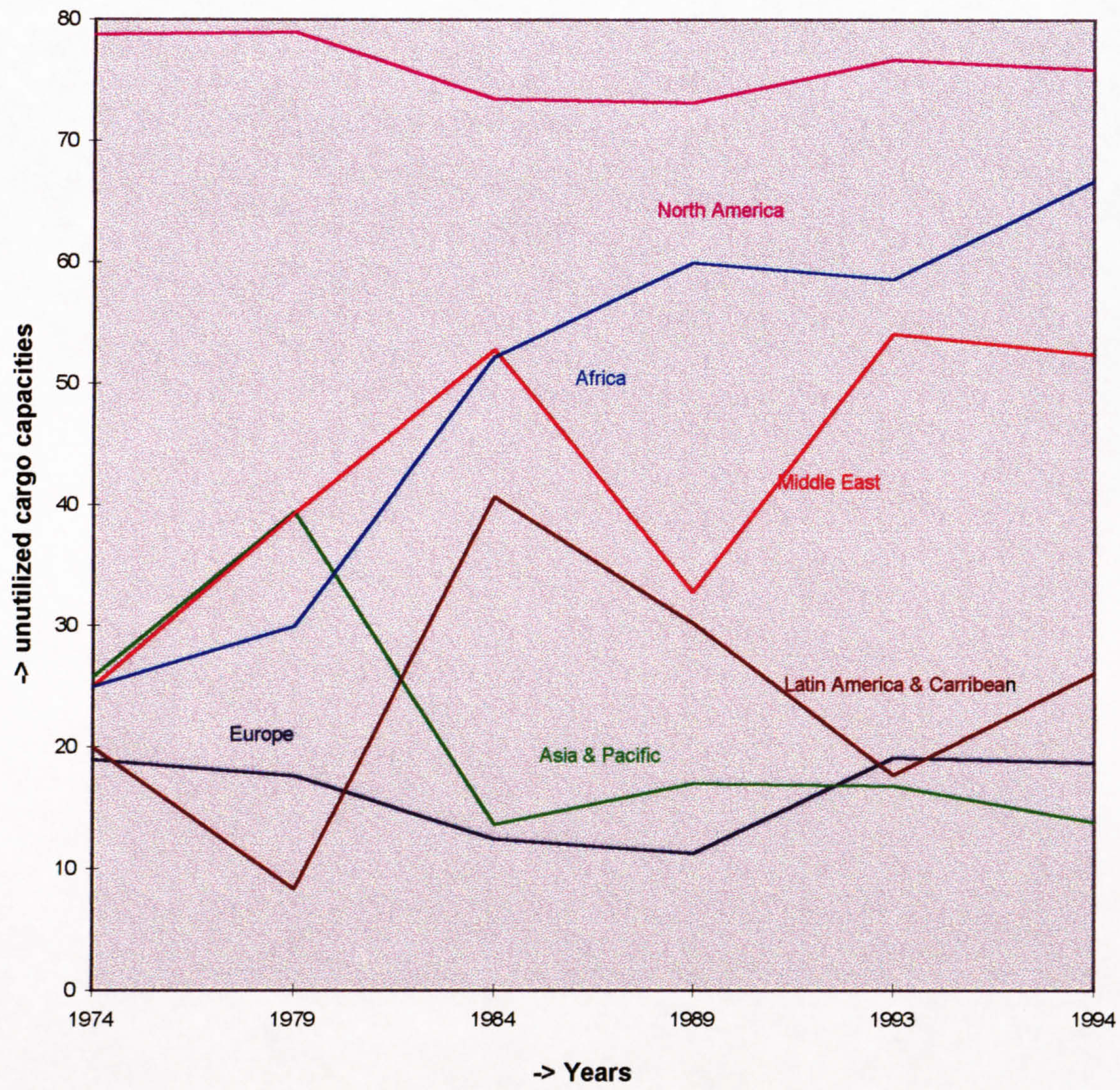


Figure 8 : Unutilized cargo capacities by region (TKs in billions, 1974- 1994)



High volume, high yield route groups are characterised by a high number of scheduled flight frequencies. High volumes of passenger and cargo traffic materialise between those regions of the world with relatively high rates of economic activity, availing their population with high per capita income and, therefore, strong purchasing power, that makes possible frequent passenger travel by air, for business or pleasure.

As for cargo traffic, given the natural, economic and human resources of a region, economic development entails that countries should specialise in the production of goods that are best produced in their own region, in quantities enough to satisfy domestic demand, and at the same time, export the surplus to international markets. The part of international trade involving the exchange of quality, specialised products is air freighted between countries and regions, in both directions. Some countries tend to export more than they import, and, as such, a directional imbalance of air cargo traffic flow, in favour of the country with the higher exports, takes place.

Countries with low air exports suffer most as they end up with a high rate of unutilised air cargo capacities on route groups connecting them internally with other countries of their own region, or externally with countries of different regions.

Each region's percentage share of total available international scheduled air cargo capacity, in relation to actual cargo handled, is shown in Appendix D, together with the region's freight load factor and the degree of cargo capacity utilisation.

Regions having a regularly high degree of unutilised cargo capacity are best suited for the introduction and development of sea-air cargo movement.

To identify the route groups with the highest degree of unutilised cargo capacity, the years 1993 and 1994 are taken as examples, to show the changes in the degree of capacity utilisation. The region's route groups' capacity utilisation trend is then traced over a twenty[1] year period as shown in Appendix D.

<u>North American Route Groups</u>:

The major route groups connecting North America with the rest of the world are in fact those of Western Europe and the Asia-Pacific, while the rest contribute less than one percentage point of total world international scheduled air cargo tonnage handled.

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1. Twenty year period starting in 1974, because 1969 -1974 represent a period of acquisition by world airlines of the then new wide-bodied aircraft introduced in 1969.

Table 10. North American Route Groups % share of world total international scheduled cargo traffic

Route groups	1993			1994		
North America	Inbound	Outbound	Total	Inbound	Outbound	Total
1. Western Europe	5.0%	4.2%	9.2%	5.1%	4.0%	9.1%
2. Asia Pacific-						
a. N.E. Asia	4.5%	2.6%	7.1%	4.8%	2.6%	7.4%
b. S.W. Pacific	0.2%	0.2%	0.4%	0.2%	0.2%	0.4%
3. South America	0.3%	0.4%	0.7%	0.3%	0.4%	0.7%
4. Rest of the World	0.1%	0.1%	0.2%	0.1%	0.1%	0.2%
Total	10.1%	7.5%	17.6%	10.5%	7.3%	17.8%
N. American TKPS share (millions)			9,800			10,600
Total international scheduled TKPs (millions)			**55,600**			**60,300**

Source: *Derived and computed from IATA Industry Statistics 1994, IATA Industry Automation and Finance Services International traffic forecasts, October 1994 and ICAO publications 158-AT/%%, 222-AT/90 and Statistical Yearbook Doc 9180/19 September 1994 and Appendix D.*

Notes:
1. *IATA Route group percentage share of inbound/outbound cargo traffic between regions, computed, adjusted and applied to ICAO actual regional performance in tonne-kilometres.*
2. *This source and note 1 apply to the rest of the Tables in this section.*

Those two route groups' international scheduled air cargo activity with North America constituted 16.3% in 1993 and 16.5% in 1994 of its total share of 17.6% and 17.8% respectively. This means that 92.6% of total north American air cargo movements is carried out by these two major regions.

The figures, as computed in Table 10, above, show that the imbalance of international trade was recurrent on two major North American route groups, in favour of air imports, with Europe having a balance of 0.8% and 1.1% in 1993 and 1994 respectively, in its favour, while this margin almost doubles in the case of North-East Asia, of 1.9% in 1993 and 2.2% in 1994. Though the directional imbalance is within a meagre 2%, it becomes a real problem when the phenomenal air cargo capacity of the North American region is related to actual tonnage handled. Freight load factors derived for the years 1993 and 1994 show a very low utilisation degree at 23.3% and 24.1%, respectively (Appendix D).

Reviewing Appendix D, the North American region suffers from the regularity of unutilised cargo capacities, beginning in 1974 at 78.8%, with noticeable improvements in 1984 and 1989, but nevertheless, unutilised air cargo capacities remained at 75.9% in 1994. Most of these unutilised capacities materialise on the outbound routes from North America to Europe and North-E Asia. The unutilised capacities can be utilised through the introduction of sea-air intermodality on air routes connecting North America with Europe, with cargoes originating in the Asia-Pacific region, and ocean-shipped to a qualified North American sea-air transfer port, for onward uplift to Europe, while the imbalance with North-east Asia can only be rectified through the conversion of a portion of high value ocean export traffic bound for North-East Asia, to the direct air freight mode.

European Route Groups:

Major route groups connect European countries with each other, on the one hand, and with the rest of the world, on the other. Large volumes of international cargo traffic flow between Europe, Asia-Pacific and North America. These volumes decrease drastically between the other three regions of the world and Europe, as shown in Table 11 below.

Table 11. Western Europe Route Groups % share of of world total international scheduled cargo traffic

Route groups	1993			1994		
Western Europe	Inbound	Outbound	Total	Inbound	Outbound	Total
1. Within Europe	3.5%	3.1%	6.6%	3.5%	2.8%	6.3%
2. North America	4.2%	5.0%	9.2%	4.0%	5.1%	9.1%
3. Asia-Pacific						
a. N.E. Asia	3.9%	3.2%	7.1%	4.3%	2.8%	7.1%
b. S.E. Asia	2.4%	1.3%	3.7%	2.0%	1.3%	3.3%
c. S.W.Pacific	0.2%	0.1%	0.3%	0.2%	0.1%	0.3%
4. South America	0.8%	0.7%	1.5%	1.0%	0.7%	1.7%
5. Middle East	1.6%	2.3%	3.8%	1.7%	2.4%	4.1%
6. Africa	0.4%	1.5%	1.9%	0.4%	1.5%	1.9%
Total	17.0%	17.2%	34.2%	17.1%	16.7%	33.8%
W. European TKPS share (millions)			19,000			20,400
Total international scheduled TKPs (millions)			55,600			60,300

Source: Same as Table 10 on page 41.

Europe's share of international scheduled air cargo capacities was 22.9% in 1993 and 23.2% in 1994, and it handled almost double the North American tonnage, with slightly over half of the North American air cargo capacity (Appendix D). Europe's total international scheduled air cargo capacity is balanced, over the two year period of analysis, at 17.0% in both directions. However, Europe/Asia-Pacific route groups show an imbalance in favour of Asia in general; with North-East Asia at 0.7% and 1.5% in 1993 and 1994 respectively, and South-East Asia at 1.1% and 0.7% for the same years. This imbalance can only be rectified through activating and motivating Asian demand for European air export products, and by converting high value ocean exports direct to the air freight mode. Sea-air intermodality has no grounds for development on these routes.

Other route groups connecting Europe with South America, are almost balanced, while route groups for Africa and the Middle East show an imbalance in favour of Europe, which means that unutilised air cargo capacities are available from those areas to Europe, and, as such, present the possibility of sea-air intermodality to be introduced via qualified African and Middle eastern sea-air ports.

Asia-Pacific Route Groups:

This region is in fact the fastest growing and most active in the world, assuming 36.3% and 37.0% of the total international scheduled cargo movements in 1993 and 1994 respectively. Appendix D shows the actual growth in tonne-kilometres performed, from 2.1 billion in 1974 to 22.3 in 1994, a growth rate of 10.6 times over the whole period.

Table 12. Asia-Pacific Route Groups % share of world total international scheduled cargo traffic

Route groups	1993			1994		
Asia-Pacific	Inbound	Outbound	Total	Inbound	Outbound	Total
a. North East Asia						
1. Within N.E.Asia	1.6%	1.9%	3.5%	1.8%	1.8%	3.6%
2. S.E. Asia	2.0%	1.7%	3.7%	2.0%	1.8%	3.8%
3. S.W.Pacific	0.4%	0.5%	0.9%	0.4%	0.5%	0.9%
4. Western Europe	3.2%	3.9%	7.1%	2.8%	4.3%	7.1%
5. North America	2.6%	4.5%	7.1%	2.6%	4.8%	7.4%
6. Middle East	-	0.2%	0.2%	-	0.2%	0.2%
Total	**9.8%**	**12.7%**	**22.5%**	**9.6%**	**13.4%**	**23.0%**
b. South East Asia						
1. Within S.E.Asia	0.8%	0.9%	1.7%	0.8%	1.0%	1.8%
2. N.E. Asia	1.3%	2.4%	3.7%	1.8%	2.0%	3.8%
3. S.W.Pacific	0.5%	0.5%	1.0%	0.7%	0.5%	1.2%
4. Western Europe	1.3%	2.4%	3.7%	1.3%	2.0%	3.3%
5. Middle East	-	0.2%	0.2%	-	0.2%	0.2%
Total	**4.3%**	**6.0%**	**10.3%**	**4.6%**	**5.7%**	**10.3%**
c. South West Pacific						
1. Within S.W.Pacific	0.5%	0.4%	0.9%	0.5%	0.4%	0.9%
2. N.E. Asia	0.5%	0.4%	0.9%	0.5%	0.4%	0.9%
3. S.E. Asia	0.5%	0.5%	1.0%	0.5%	0.7%	1.2%
4. North America	0.2%	0.2%	0.4%	0.2%	0.2%	0.4%
5. Western Europe	0.1%	0.2%	0.3%	0.1%	0.2%	0.3%
Total	**1.8%**	**1.7%**	**3.5%**	**1.8%**	**1.9%**	**3.7%**
Asia-Pacific grand total	**15.9%**	**20.4%**	**36.3%**	**16.0%**	**21.0%**	**37.0%**
Asia-Pacific TKPS share (millions)			20,200			22,300
Total international scheduled TKPs (millions)			55,600			60,300

Source: Same as Table 10, page 41.

Due to the relatively large geographic area, the long distances that must be flown to connect various countries of this region and the newly earned wealth of its dense population, three major route groups connect the Asia-Pacific region with each other and with the rest of the world.

Within the region, North-East Asia route groups handle the largest volume of freight movement of 62.2% of the region's total, while South-East Asia route groups handle 27.8% and that of the South-West Pacific hover around the 10.0% mark. Its share of the world total is spread over route groups as follows:

		1993	1994
1.	within Asia-Pacific	17.3%	18.1%
2.	with Europe	11.1%	10.7%
3.	with North America	7.5%	7.8%
4.	with the Middle East	0.4%	0.4%
		36.3%	37.0%

This means that approximately 50% of the Asia-Pacific share of 36.3% and 37.0% occurs within the region itself, and the balance with mainly Europe, North America and to a much lesser extent, the Middle East.

The Asia-Pacific region enjoys a net imbalance in its favour, with all three regions, of 4.2% and 4.9% of total international scheduled cargo traffic, for the two years under analysis:

		1993	1994
1.	N.E. Asia with Europe at	0.7%	1.5%
2.	N.E. Asia with N. America at	1.9%	2.2%
3.	S.E. Asia with Europe at	1.1%	0.7%
4.	S.W. Pacific with Europe at	0.1%	0.1%
5.	N. & S.E. Asia with the M.E. at	0.4%	0.4%
		4.2%	4.9%

The increase in the net imbalance of 0.7% during one year, between 1993 and 1994, shows that the trend of increased Asia air exports versus air imports is growing fast. Most of the net additional growth occurred with Europe and North America, while the net imbalance with the Middle East remained stable.

This means that Europe and North America are increasing their air imports vis-á-vis air exports, from/to the Asia-Pacific region. Therefore, more unutilised air cargo capacities become available from North America, Europe and the Middle East to the Asia-Pacific region, and therefore present fertile ground for the introduction of sea-air as fill-in cargo. The conversion of a portion of high value ocean cargo traffic, bound for the Asia-Pacific region, to the sea-air mode, would help to partially rectify this imbalance.

Other Route Groups:

The remaining three regions of the world, namely the Middle east, Africa and South America, assume altogether less than 12% of the total international scheduled cargo activity.

The Middle East Route Group:

As shown in Table 13 below, the Middle East region assumes over 42% of the remaining three region's total international cargo traffic, and has a much wider connection of route groups with Europe, North/South east Asia, Africa and the rest of the world, which includes North America and the South West Pacific.

The Middle East region is largely an importing one, showing regular imbalance with North/South East Asia and Europe. The only imbalance in its favour is shown on route groups connecting it with Africa and the 'Rest of the World'. Because of its geographic location, 'midway' between the routes connecting the Asia-Pacific with Europe and Africa, most of the Middle-East's outbound cargo traffic is transit freight, originating in the Asia-Pacific region or Europe. As such, it presents a strategically ideal location for sea-air intermodality to develop and grow.

The people of the Middle East region are traditionally classified as 'consuming' people, who import most of their needs from mainly Europe, North America and Asia-Pacific. The region's oil industry dominates its economic activity to a very large extent. Light industries in the 'wearing apparel' field, such as the readymade garments industry, extending to shoe factories, furniture industries, etc. mushroomed from the 1980s onwards, and the products are partly air-exported to North America, Europe and Africa, thus marginally helping to rectify the regularity of its imbalance with these regions, especially with Europe.

Table 13. Middle East Route Groups % share of world total international scheduled cargo traffic

Route groups		1993			1994	
Middle East	Inbound	Outbound	Total	Inbound	Outbound	Total
1. Europe	2.3%	1.6%	3.9%	2.4%	1.7%	4.1%
2. N.E. Asia	0.2%	0.0%	0.2%	0.2%	0.0%	0.2%
3. S.E. Asia	0.2%	0.0%	0.2%	0.2%	0.0%	0.2%
4. Africa	0.1%	0.2%	0.3%	0.1%	0.1%	0.2%
5. Rest of the World	0.1%	0.3%	0.4%	0.1%	0.1%	0.2%
Total	2.9%	2.1%	5.0%	3.0%	1.9%	4.9%
Middle East TKPS share (millions)			2,800			3,000
Total international scheduled TKPs (millions)			55,600			60,300

Source: Same as Table 10, page 41.

Africa Route Group :

As seen in Table 14 below, almost all of Africa's international scheduled cargo movement falls under the domain of Europe, and suffers a chronic imbalance, greatly in favour of Europe. It presents very good grounds for the introduction and development of the sea-air mode via a qualified African sea-air transfer port, mainly for re-distribution by air to various landlocked African states.

The imbalance on the international route groups, connecting Africa with Europe, are bound to remain in Europe's favour for a long time to come, as African industries are still very primitive and barely able to cope with domestic demand.

Table 14. Africa Route Groups % share of world total international scheduled cargo traffic

Route groups	1993			1994		
Africa	Inbound	Outbound	Total	Inbound	Outbound	Total
1. Europe	1.5%	0.4%	1.9%	1.5%	0.4%	1.9%
2. Middle East	0.2%	0.1%	0.3%	0.1%	0.1%	0.2%
Total	1.7%	0.5%	2.2%	1.6%	0.5%	2.1%
Africa' TKPS share (millions)			1,200			1,300
Total international scheduled TKPs (millions)			55,600			60,300

Source: Same as Table 10, page 41.

South America Route Group :

The South American region has, however, demonstrated a remarkable activity of balancing cargo movements on its route groups, to one tenth of a percentage point. This is mainly due to the high air exports of perishables such as general foodstuffs, meat, fresh fruits, vegetables, flowers, plants and the like, to North America and Europe, who dominate the international scheduled cargo traffic with South America.

It should be noted that over 50% of South American international scheduled cargo traffic occurs within the region itself (Table 15 on page 47). The introduction and development of sea-air intermodality in this market depends largely on the North American demand for Latin American products. A large number of Latin Americans are permanently residing in North America, and hold strong ties to their Latin American roots, resulting in a continuous and growing demand for their original home products.

For example, hundreds of cargo flights depart Miami Airport every day to points in South America to bring back highly demanded foodstuffs and perishables. The possibilities for sea-air cargo exists as optional 'fill-in' cargo on the first leg of the journey from North America to south America.

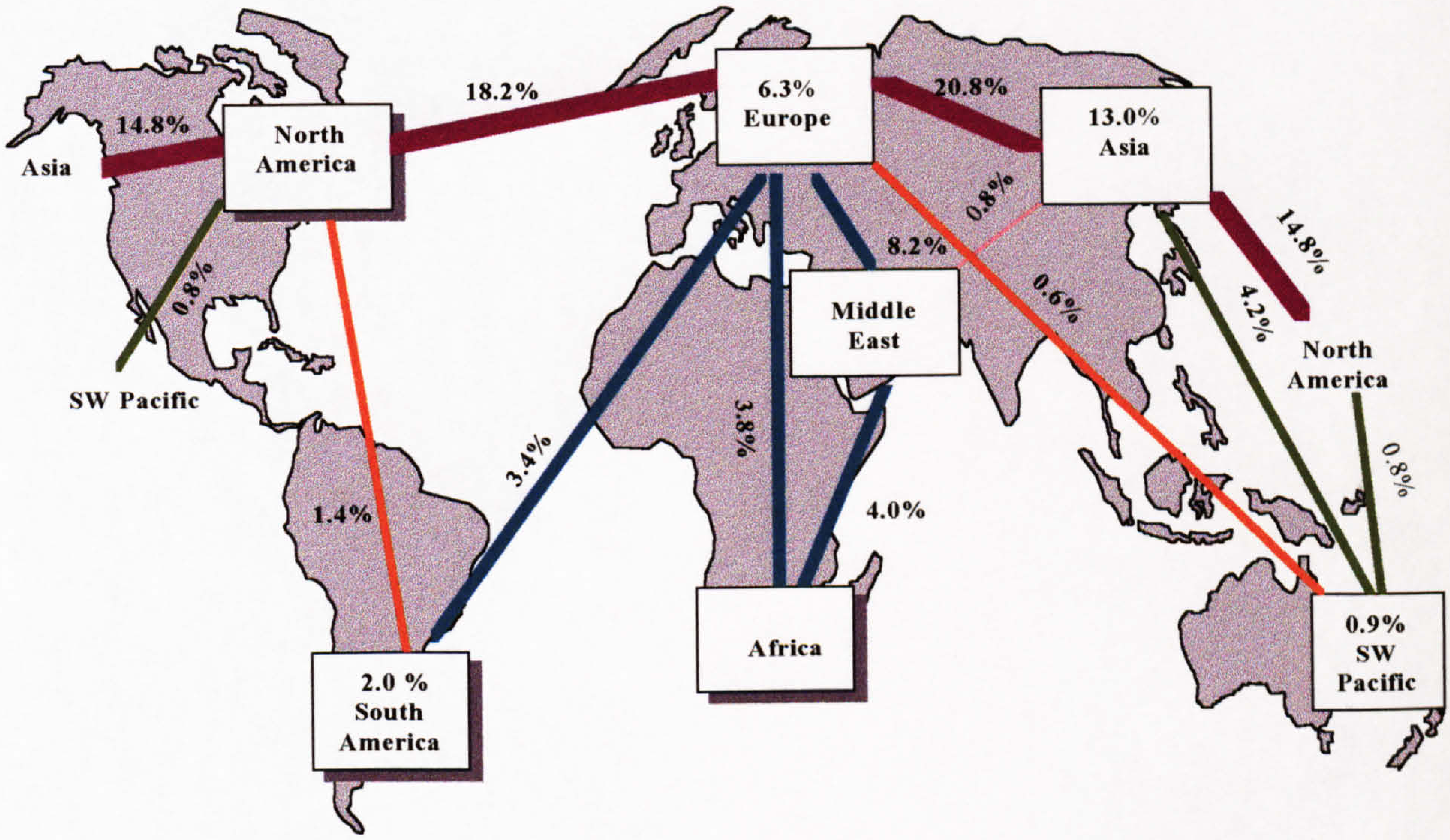
Table 15. South America Route Groups % share of world total international scheduled cargo traffic

Route groups	1993			1994		
South America	Inbound	Outbound	Total	Inbound	Outbound	Total
1. Within S. America	1.3%	1.2%	2.5%	1.0%	1.0%	2.0%
2. N. America	0.4%	0.3%	0.7%	0.4%	0.3%	0.7%
5. Europe	0.7%	0.8%	1.5%	0.7%	1.0%	1.7%
Total	2.4%	2.3%	4.7%	2.1%	2.3%	4.4%
South America TKPs share (millions)			2,600			2,800
Total international scheduled TKPs (millions)			55,600			60,300

Source: Same as Table 10, page 41.

Below is a summary of major world cargo traffic flows between regions, as a percentage of ICAO total scheduled international cargo traffic performed in TKs, 1994.

Figure 9 :

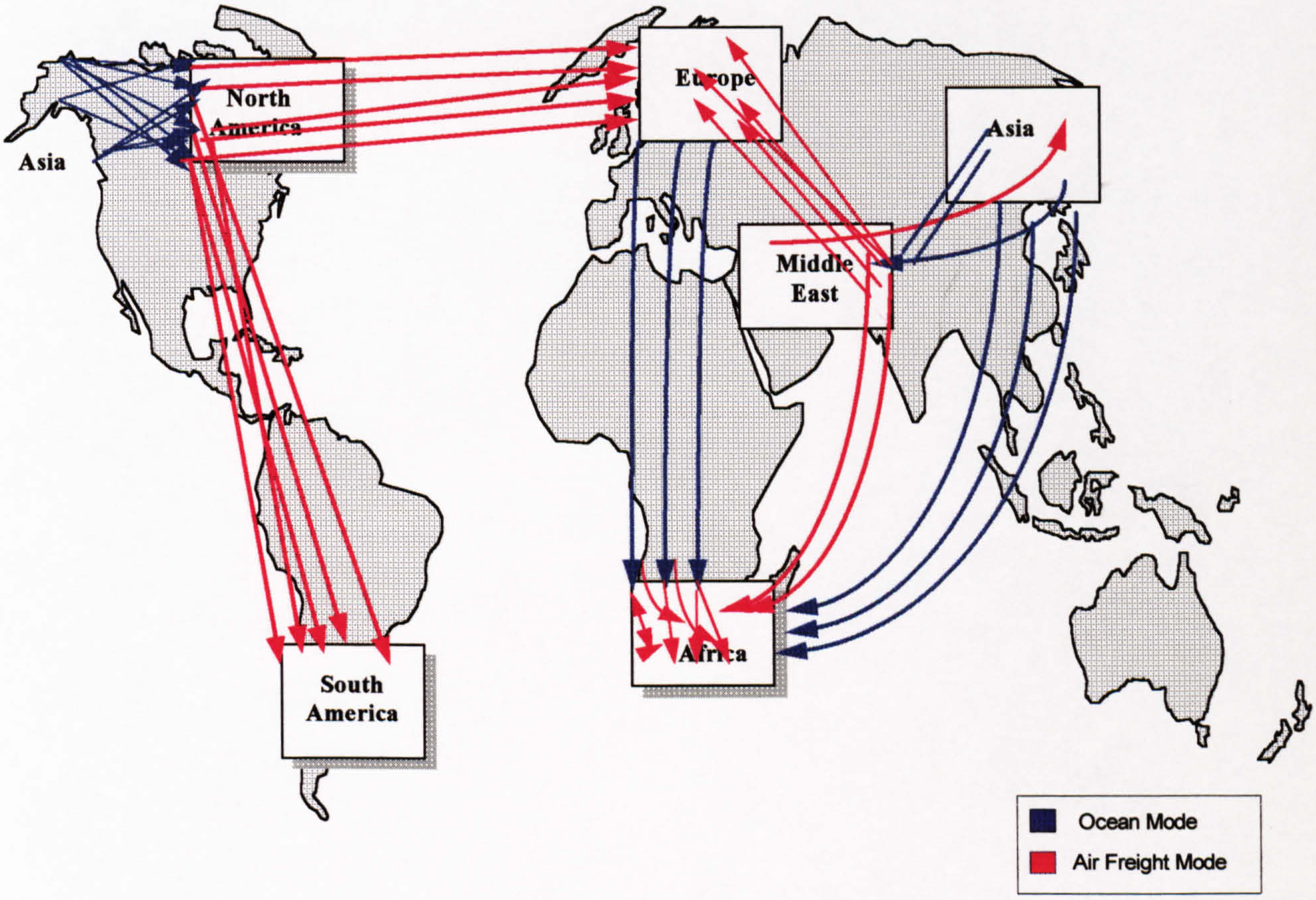


Notes:

1. Traffic flows between regions less than 0.1% are not shown (totalling 0.4% recorded under 'Rest of the World' in Tables 10 and 13 on pages 41 and 45 respectively).
2. Traffic within regions shown in boxes.

Major potential sea-air routes

Figure 10 :



1. **North American sea-air routes via North America**:
   Cargo arrives at North American ports by ocean from Asia, and departs by air to Europe and South America.

2. **European sea-air routes via Africa**:
   Cargo arrives at African or Middle Eastern ports by ocean, and departs by air to various states within Africa.

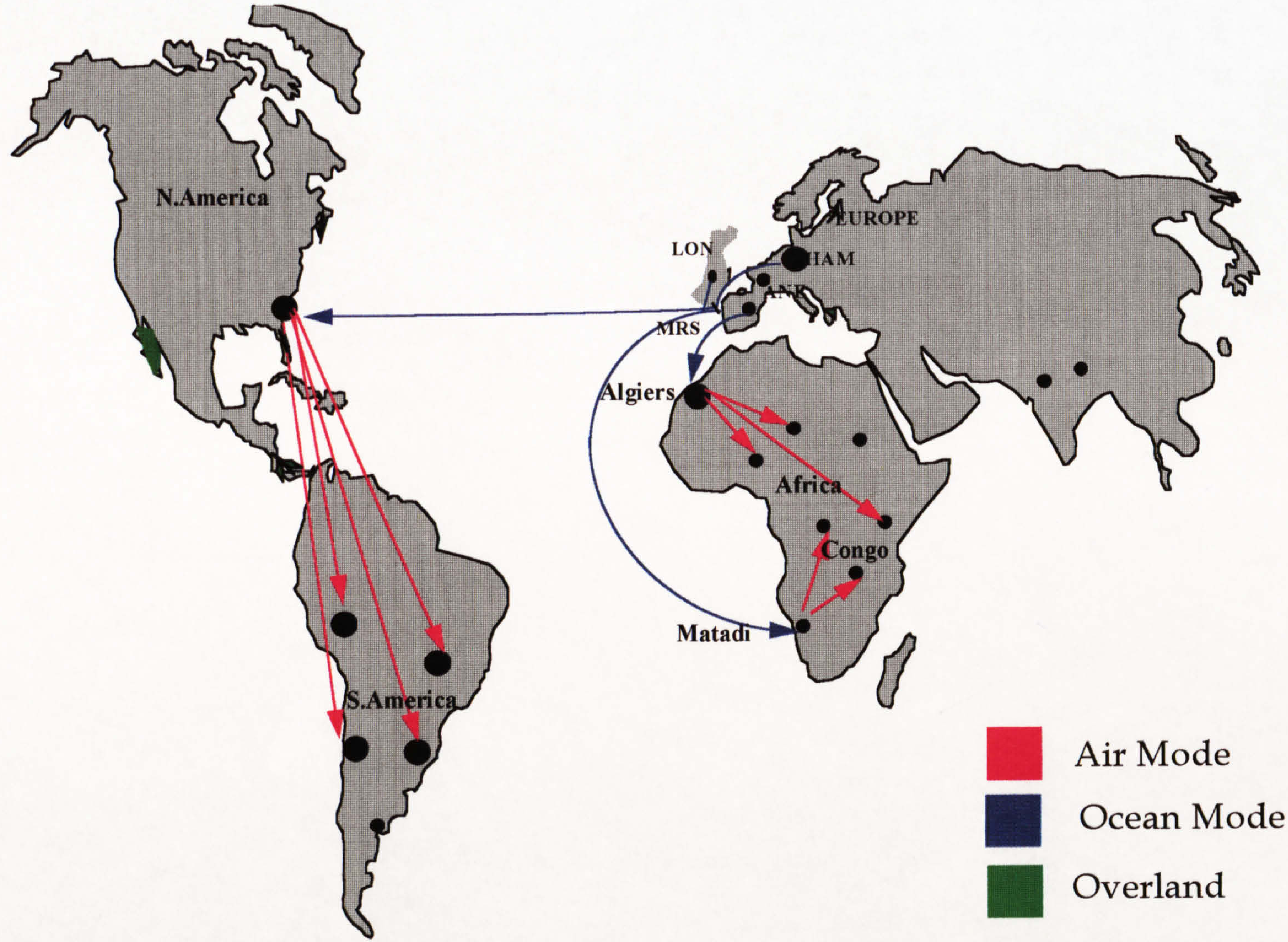
3. **European sea-air routes via the Middle East**:
   Cargo arrives from Europe to Middle Eastern ports by ocean, and departs by air to the Asia-Pacific region.

4. **The Asian sea-air routes via the Middle East**:
   Cargo arrives at Middle Eastern ports by ocean from Asia, and departs by air to Europe and Africa.

5. **The Asian sea-air routes via Africa**:
   Cargo arrives at African ports by ocean from Asia, and departs by air to various states within Africa.

Part II: *Analysis of sea-air routes*.

Figure 11 : Early Sea- Air Routes



Chapter 4

Sea-air intermodality - history and development, the early routes.

After the Second World war, several combined sea-air services were attempted in the international transport system. These attempts, on different routes, were pioneered by freight forwarders and NVOCCs, in co-operation with air carriers, and to a lesser extent with shipping lines[1].

4.1 The sea-air route from Europe to South America[2]

In 1955, the freight forwarding agency 'Kuhne and Nagel' established a sea-air service to South America via New York as a transfer port. They named the service'Sea-air Express'. The sea-air route started from factories in West Germany to the gateway port of Hamburg. Cargo moved on the first leg of the journey, from Hamburg to New York by ocean, and from New York, by air, to various destinations in south America. The whole journey from origin to destination consumed a transit time of 13 to 16 days. The basic element that was considered at that time was to decrease the cost of transportation, as compared with direct air freight cost.

The extension of transport time was a disadvantage in relation to direct air freight - 13 to 16 days for sea-air, as compared with 3 to 4 days for direct air freight. But the sea-air transit time still had a clear advantage over all ocean transport time of 35 to 40 days. However, it must be stressed that most of the freight that moved via the sea-air mode, during the period 1955 to 1970, was cargo that would have moved by direct air freight, where air cargo capacities were available, rather than by direct ocean. But aircraft serving flights between Germany and South America were still mainly narrow-bodied and were unable to cope with cargo demand at that time. It was the first time a combined transport project was initiated by a freight forwarder.

1. Tsuneo Tanasa, (1988) 'Sea-Air - The New Opportunities', a research presented at the 'Pacific Transport Freight Seminar', Raffles City, Singapore, 20 - 23 June, 1988.

2. 'Sea-air Cargo - an Introduction' (1988), Vereingte Motor-Verlage GmbH & Company, Stuttgart, Germany.

4.2 The Europe - Africa route

From 1955 onward, and until the late 1960s, many sea-air services were initiated between Europe and Africa. Sabena, the Belgian airline, in co-operation with a number of freight forwarders, was the launching airline for this type of transportation between Europe and the Congo (now Zaire). Sea-air service from Belgium to the Congo (Zaire) was offered for several years starting from 1955 until 1965. Cargo moved by ocean from Antwerp to the port of Matadi, then onward by air to various inland points. This service was limited to the availability of cargo space on flights from Matadi to various Belgian-controlled areas in Africa.

The French airline UTA followed the Belgians, and in co-operation with 'Companie Maritime des Charges Reunis', offered a similar sea-air service from the port of Marseilles, as a gateway port, to points in French controlled central Africa. This service, like Sabena, had many disadvantages, the major one being the very limited air cargo space that was available from the transfer port to points inland.

It should be noted that not all these attempts at intermodality were directed at decreasing the cost of transportation. Many destinations in Africa were very difficult to serve by conventional means of transport, such as direct ocean shipping and direct air freight. Shipping lines were serving the main gateway ports of Africa as a whole. From the gateway ports to points inland, overland services (whether by truck or by rail) were either non-existent or very poor. The same was true for air carriers who served main or capital cities of Africa with narrow bodied aircraft, which had very limited cargo space that was sold, in most cases, to the passengers in the form of unaccompanied cargo.

Such was the air-sea service offered by Air France from London to Algeria, via Marseilles, as a transfer port. This service was started in the late 1950s and continued until 1965. The frequency of flights from London to Algeria was low, two to three flights per week, with very narrow bodied aircraft and hardly any cargo capacities. Further, cargo space was heavily overbooked by the passengers themselves.

During the period between 1958 to 1965, the air-sea service by Air France came about as a direct response to market demand. On the first leg of the journey, cargo was carried by air from London to Marseilles, while cargo on the second segment of the journey, from Marseilles to Algeria, was carried by sea. The combined transport service resulted in a higher cost than direct air freight, but amazingly the objective of introducing this particular air-sea service was to reduce the duration of direct air freight transit time, rather than direct ocean shipping transit time. Direct air freight from London to Algeria was restricted to a very few flights, and so plagued with overbooking that shipments had to wait at London Airport[1] for 14 to 21 days, and during the summer season, up to 25 days. The air-sea service by Air France reduced the transit time to an average of 9 days via Marseille.

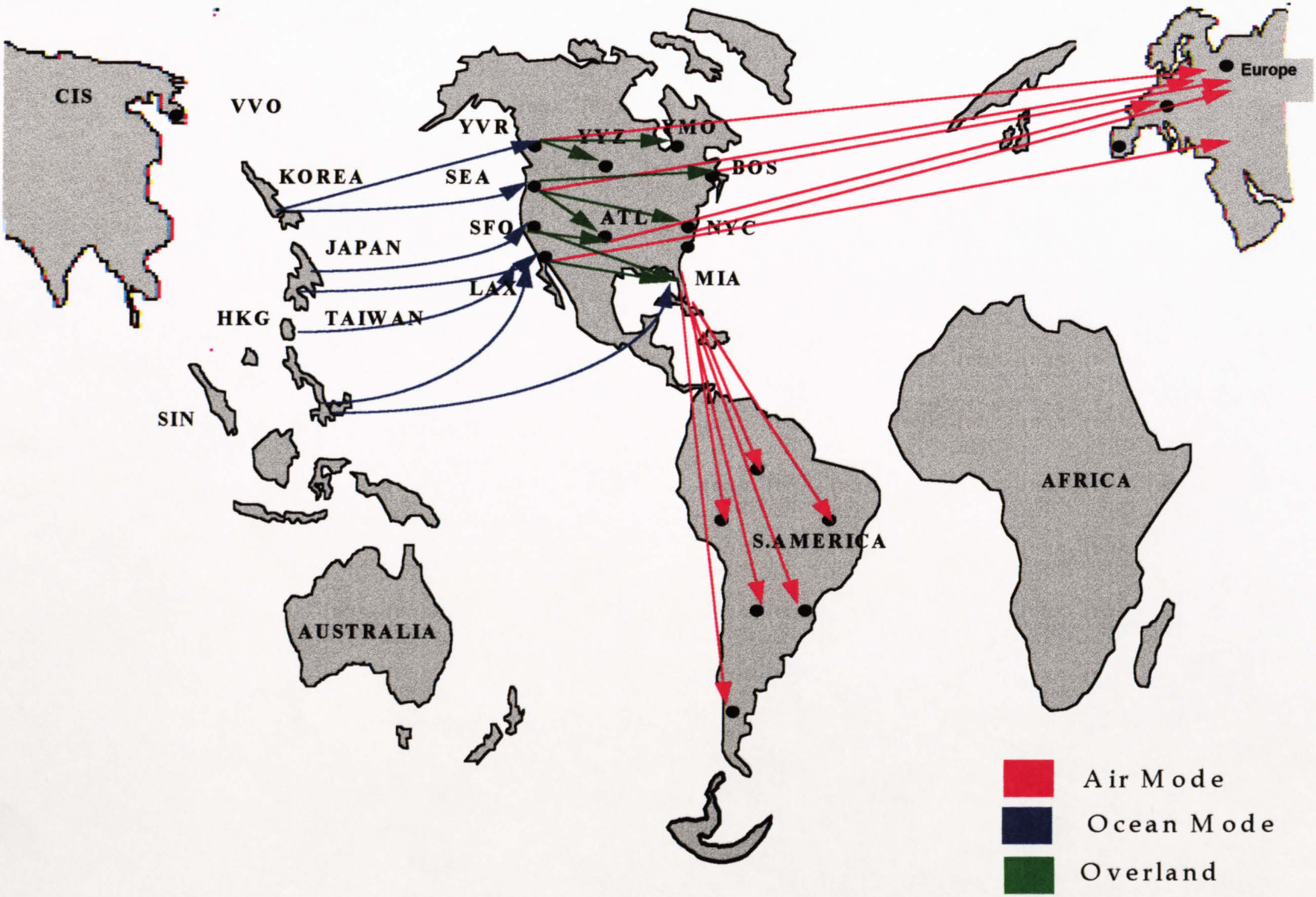
All these intermodal services from Europe to Africa faded away during the late 1960s, and early 1970s. The introduction of wide-bodied aircraft, namely the B 747, together with the large and fast container ships, had an impact on the gradual disappearance of these services.

Pure cargo flights, using wide-bodied aircraft (B 747s), were introduced by the Belgian airline Sabena from Brussels to Central Africa, namely Zaire and other cities. UTA followed suit in the early 1970s, introducing similar flights to Brazaville and many other French controlled points in Africa.

Portuguese airlines also started direct wide-bodied flights to points under their influence in Africa. Shipping lines using large and fast container ships started calling at African ports and delivering cargoes in containers further inland, either on their own trucking fleets, or on hired ones with much less dependence on the then available services of the largely antiquated African railway systems. Infrastructure developments in Africa, in terms of advanced airports and ports, cargo handling facilities, construction of modern motorways and railways did contribute to the changes that occurred, slowly and gradually from the early 1970s to the present day in 1994.

1. From an interview with the Regional Director, Air France in U.K., August 1988.

Figure 12 : The Sea-Air Western Routes



Chapter 5

The Western routes via North America Far East to Europe

Introduction

The emergence and development of the sea-air cargo flow, via the North American west coast[1], was prompted by the introduction of wide bodied aircraft in the late 1960s, first in N. America, and gradually to the rest of the world, resulting in the availability of huge air cargo capacities from points on the west coast to points on the east coast and Europe. Low cargo rates were offered in the market to fill in the unutilised air capacities that became suddenly available on all airline flight services using wide-bodied jets.

The availability of huge air cargo capacities, from the west coast, was mainly due to the fact that the majority of heavy industries are located on the east coast of America, Europe and the Far East, and therefore the flow of goods by air from those areas to the rest of the world was by far greater than on the return leg. This was what caused the imbalance in the two way air cargo traffic.

Sea-air cargo was developed from the Far East mainly from Japan, South Korea and Taiwan, as an option to direct air freight which was very costly[2]. Sea-air was also developed as an option to the long transit time of ocean freight of 7 to 8 weeks. Cargo moved by ocean to the west coast main gateways, then transferred on to railways or truck trailers to points in the American continent.

Cargo bound for Europe was either air freighted directly from the west coast airports or from the east coast airports after a long journey overland. This field research on sea-air transfer ports of North America covers Vancouver, Seattle, Los Angeles, San Francisco on the west coast, and Miami on the east coast. It should be noted that from the San Francisco Bay area, freight volume is very small in relation to other transfer ports, due mainly to limited shipping line services, and the lack of interest in sea-air cargo by the American carriers.

A note on methodology

In the section that follows, a detailed analysis of each of the current world active sea-air transfer hubs is made. Much of the data required for the analysis was either lacking or totally inaccurate, from the sources approached, especially some Port

1. Gray, T. (1986) 'Why the Sea-Air Concept is Taking Off'. Lloyd's List, November 14, 1986.
2. Direct air freight from points in the Far East to points on the west coast, was very costly due to its one way payload revenues. The return leg back to the Far East produced hardly any revenue because of the scarcity of cargo. In order to make up for the loss of revenue on this sector, airlines applied very high rates on the first leg (Far East to North American west coast).

Authorities, airlines and shipping lines, who considered the data required as classified. Intensive field research played a very important role in this exercise :

1. Collection and assessment of data available from Port Authorities, local government entities, wherever relevant, was made.

2. Collection and analysis of data and other relevant information, including interviews with Freight Forwarders, airlines, shipping lines and port officials, was made.

3. The sea-air market and factors related to its growth and/or decline, were subjected to intensive analysis.

4. Tabulation of statistical figures was made in the most accurate technique, and specifically figures of available air cargo capacities on scheduled international services of the carriers operating from/to each of the sea-air transfer hubs under review. An account of the technique adopted is detailed in Appendix E.

5.1 The sea-air route via Vancouver

A sea-air route via Vancouver was started in the early 1960s[1] by Air Canada (then called Trans Canada Airlines). The idea was to speed up delivery of high value Japanese consumer goods to various destinations deep within America. Cargo was shipped from Yokohama to Vancouver by ocean, then hauled overland to Vancouver International Airport for onward carriage by air to inland points within America and the East Coast. The sea-air journey from origin to final destination took an average of 18 days. KLM, the Royal Dutch Airline, took the initiative of introducing the service beyond the continent of America, and started the sea-air services via Vancouver to various points in Europe. It took 21 days to carry the freight from Japan to Europe by sea-air via Vancouver, whereas all ocean transport took 7 to 8 weeks to reach inland destinations in Europe.

In the middle of the 1960s numerous accidents occurred during bulk transhipments, which almost brought about the cessation of the service. But as container ships and jumbo jet freighters were introduced in the 1970s, the routes and services were upgraded and further developed.

Firstly to North America, by the transfer of containers from onboard ships at Vancouver Port to onboard heavy duty truck trailers bound either to inland destinations in America, or to Vancouver airport for destuffing and eventual air carriage to final destinations.

1. From interviews with Air Canada management in Vancouver and Toronto, July 1992, by the writer.

Secondly to Europe, by the transfer of containers from onboard ships to the railways bound for the Toronto container terminal where cargo is de-stuffed and trucked to airline (mainly Air Canada and KLM) cargo receiving bays, for palletising and consequential air lift, to various destinations in Europe.

Sea-air movement continued steadily through the 1970s[1] until the early 1980s, with air carriers playing the major role[2]. There were a few attempts by a handful of freight forwarders, led by 'Concorde Express'[3], aimed at expanding their control over the sea-air cargo flow. Those attempts were promptly met by fierce resistance from Air Canada and the Canadian Customs Authorities. Sufferance warehousing rules were introduced in 1982 which stipulated that freight forwarders could only move their cargo through airline warehouses within the airport, otherwise they had to go off the airport premises.

Further, the airport did not provide any special facility or incentive to sea-air operators such as priority handling[4]. On the other hand, the port of Vancouver has been traditionally a gateway for all kinds of freight. It was, and still is, an export oriented port, mainly for bulk cargo (containerisation degree was 37.5% of general cargo in 1994). Up to 1990, the container terminal capacity of half a million containers, including empties, was never fully utilised, and the utilisation rate of the terminal usable area varied between 56% to 65% per year (Table 16, below). Despite this fact, a second new container terminal, more than double the size of the present one, is planned to start operating by the end of 1995.

Table 16: Vancouver Port

Analysis of container traffic

Tonnage: in thousands. Containers: in thousands

Port	1987	1988	1989	1990	1991	1992	1993[1]	1994[2]
Vancouver Port								
Total no. of containers handled.	280	306	306	323	384	441	430	425
Total container tonnage	2,409	2,732	2,645	2,708	3,290	3,624	3,570	3,450
Containerisation degree (% of general cargo)	**27.5%**	**28.3%**	**28.5%**	**29.0%**	**33.3%**	**36.6**	**37.1%**	**37.5%**
Av. tonnage/container	**8.6**	**8.9**	**8.6**	**8.4**	**8.6**	**8.2**	**8.3**	**8.1**

Source : *ISL Shipping Statistics Yearbook, Institute of Shipping and Logistics (ISL), Bremen, October 1993.*

Notes : *Figures 1987 to 1992 were derived from ISL Yearbook 1993.*

1. & 2 : *Figures for 1993 and 1994 were derived from related periodicals and tested against ISL figures, and average percentage changes per year over six years (1987 - 1992) - periodicals such as the ICHCA Annual Review, World of cargo handling, London, March 1995.*

1. On the progress of intermodal transportation, see: Marwick, Peat and partners (1980), 'Intermodal transportation for containers and trailers (Ottawa : Canadian Transport Commission)
2. Mahoney, J. H. (1985), 'Intermodal Freight Transportation', Westport: ENO Foundation for Transportation Inc.
3. Concorde Express - a multi-national Freight Forwarder and Sea-Air Operator.
4. Priority Handling : The provision of special parking lots for trucks off-loading sea-air cargo, special attendance by skilled airport labour, availability of cargo receiving bays, and palletisation outside office hours.

The low rate of Vancouver Port Terminal utilisation, and their plan for a controversial new second terminal, together with the sluggish demand by international shipping lines to use Vancouver Port, did not fully convince Port Authorities to offer special facilities for import cargo, especially sea-air cargo, and remained rigid in its built-in export oriented image. Further hindrance to the possible introduction of sea-air facilities came about in the form of labour union periodic strikes that paralysed the Port activities from time to time.

A large number of shipping lines from Japan and South Korea re-scheduled their first port of call from Vancouver to Seattle, while the rest rescheduled to Los Angeles and San Francisco. Seattle became the biggest sea-air hub on the US west coast. Freight forwarders who were denied entry into the sea-air market in Vancouver, found a warm welcome by Seattle Port Authorities who immediately responded with priority handling to the sea-air containers.

The reaction from Vancouver Authorities was gradual and spread over a decade. The first measure by Vancouver Airport was the creation of a committee of freight forwarders in 1984[1], without any airline participation, with the aim of improving the sea-air service.

The second measure which followed in 1986, was to ease the sufferance warehousing rules. Freight forwarders were allowed to use their own warehouses at the airport and receive cargoes directly from the port. For the first time, freight forwarders started destuffing containers themselves and building pallets for air carriage to final destinations, without airline handling interference.

The third measure came about on the 1st of July 1992. Vancouver airport was placed under the management of a local board of directors aiming at drastic changes in policy; the main target of the board was to market Vancouver Airport as an international gateway and a transit hub, by attracting new carriers and cargoes from the West Coast of the USA, especially from Seattle Port, via a trucking programme linking Seattle and Tacoma with 3 hours trucking time.

The fourth measure came in 1992 from the port of Vancouver who offered shipping lines lower charges for container handling. Well aware of the 30% average unutilised capacity of the present terminal, and with a second terminal of almost double capacity being built for opening by the end of 1995, Vancouver port realised the importance of attracting the shipping lines again to reschedule their first port of call to Vancouver.

The sea-air markets of Vancouver Port and Airport were subjected to questionnaires and direct interviews by the researcher in 1992, who came out with the following first hand findings :

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1. Interviews with Vancouver Airport officials, and the Department of Transport Canada, Vancouver in July 1992, by the writer.

1. A decline in sea-air tonnage flow through Vancouver Airport was confirmed by Air Canada, KLM and Vancouver Airport based sea-air operators and freight forwarders.

2. An increase of sea-air cargo traffic was reported by the majority of international shipping lines using either Seattle or Vancouver Port as the first port of call. The shipping lines contacted were APL (American President Line), Hyundai, K Line, Mitsui OSK, Sealand and Maersk. A drastic increase was reported to have occurred during the third quarter of 1990, continuing in force till the second quarter of 1991, and reached a staggering figure of almost 20,000 tonnes shared between the ports of Seattle, Los Angeles and Vancouver. Most of the shipping lines confirmed a share of approximately 25% of this increase to have been off-loaded at the Port of Vancouver. This increase was not shown or reported by Vancouver Airport, but was reported[1] to have been railed to Toronto Airport for further uplift to points in Europe.

   All shipping lines confirmed that this windfall increase was a direct result of the Arab Gulf crisis, and the immediate shift to North American sea-air transfer hubs of approximately two-thirds of the total sea-air cargo that was otherwise routed via the U.A.E. ports and one-third to the sea-air transfer hub of Singapore (an average of 30,000 tonnes per annum[2], of sea-air cargo was moving via the sea-air transfer hubs of the United Arab Emirates in 1990 and 1991). The windfall improvement of Vancouver Container Terminal utilisation rate, of 77% in 1991 and 88% in 1992 gradually fell back to 86% in 1993 and 85% in 1994. With the return to normalcy of the U.A.E. ports, the declining trend is expected to continue in 1995 and 1996 and stabilise at an annual growth rate of 5% over the pre Arab Gulf War rate of 65%..

3. Data on the decline or growth of sea-air cargo, via both Vancouver Port and Airport, was not available from official sources. The Marketing Department of Transport Canada, in Vancouver stated that statistics on sea-air cargo are non-existent. Further, data on airline activities was considered classified information. However, the researcher managed to compile in Table 17, on page 60, the 'best estimates' figures from a memo, dated August 1992, by Mr. Hans Erkens, Director of Market Development at Vancouver Airport, which was later verified and updated in September 1994 through direct contact and interviews with shipping lines, airlines and sea-air operators, all based in Vancouver and Seattle.

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1. Source : Port Rashid (Dubai). Dubai Airport Civil Aviation and Sharjah Airport Authorities monthly and annual official releases of sea-air cargo volume statistics.
2. Source : Kintetsu World Express, Adanac International Forwarders & HECNY Transport - all based in Vancouver.

Table 17: Port of Vancouver sea-air cargo to Europe (in tonnes)

Origin	1987	1988	1989	1990	1991	1992	1993	1994
Japan	2,350	4,700	6,050	6,250	6,100	6,150	6,200	6,300
Korea	250	500	550	600	650	650	700	700
Taiwan	750	1,400	1,500	5,500	4,500	2,100	2,000	1,800
Others	600	1,300	1,100	2,500	3,500	1,500	1,200	1,300
Total	3,950	7,900	9,200	14,850	14,750	10,400	10,100	10,100

Source: Researcher's direct interviews with shipping lines, airlines, sea-air operators and memos of the Market Development Board- Vancouver.

Airlines and freight forwarders in the market did not share the optimism of Mr. Hans Erkens' figures, which were on average 30% higher than all figures in Table 17, above. Their reasons being:

(a) Vancouver Port receives a relatively small quantity of sea-air cargo, as most shipping lines call first at Tacoma or Seattle. Then, sea-air cargo which is in excess of available air capacities at Seattle airport, is trucked or railed, or a combination of both, in containers to airports where air capacities were available, such as Vancouver, Toronto, Montreal, Atlanta and Miami. The air cargo capacities available from Toronto and Montreal, can be seen in Appendices E-2 and E-3.

(b) Air cargo capacity, of Vancouver Airport, was limited to a once weekly DC8 Air Canada freighter, starting from Vancouver via Toronto to Amsterdam and to passenger flights starting from Seattle via Vancouver to Amsterdam, Frankfurt, Paris and London (Appendix E-1). All passenger flights' underdeck capacities were loaded with sea-air cargo first in Seattle, and whatever remaining unutilised capacities were filled in Vancouver.

The fifth development that came about was that Air Canada stopped selling sea-air cargo on a direct shipper basis in Japan as of 1st January 1989, something they had done since the conception of the sea-air idea in the 1960s. In particular, the Air Canada once weekly DC8 freighter capacity was mainly used by one freight forwarder - Kintetsu World Express.

As from 1992, Air Canada offered their air cargo capacity to the forwarding industry as a whole. As indicated by Air Canada management, they carried about 80 tonnes a week on flights from Vancouver to Europe via Toronto during 1990 and 1991. Sea-air cargo would make about 80%[1] of this figure, i.e. about 65 tonnes

1. Interviews with Air Canada management in Vancouver and Toronto, in July 1992 revealed sea-air figures as prepared by Air Canada and Toronto and Vancouver airports, to range between 8,500 - 9,000 tonnes per annum, for the years 1991 and 1992. Air Canada carried an average of 65 tonnes per week as per their records, which meant 65 x 52, i.e. 3,380 tonnes per annum, or just under 40% of the total sea-air tonnage per year via both Vancouver and Toronto. KLM combi flights from Toronto to Amsterdam during the same period, 1991 and 1992, carried approximately 3,500 tonnes/year, which meant 40% of sea-air cargo was carried by KLM. The above figures were derived from direct interviews with Air Canada and KLM managements in Vancouver and Toronto.

(including the freighter service), which means Air Canada's share was just under 40% of the sea-air market, while KLM combi flights assumed another 40 % of the sea-air market. The remaining 20% was shared by Canadian airlines International , Lufthansa and British Airways.

Vancouver Airport sea-air cargo traffic figures, based on interviews with freight forwarders, sea-air operators, Air Canada and Lufthansa are as follows:

Year	1990	1991	1992	1993	1994
Tonnes	8,600	8,700	9,000	9,150	9,250

The numbers are significantly smaller than those indicated by Transport Canada in Vancouver. During interviews with the freight forwarding community in Vancouver, the above figures were reconfirmed by the majority, as they were in line with total available air capacities. Rounded estimates of the 1991 sea-air volume via Vancouver Airport range between 8,000 and 9,000 tonnes per year.

One reason that could account for the discrepancy between these research findings, and those indicated by Transport Canada, is that consolidated sea-air cargo arriving by ocean transits Vancouver before being railed onward for uplift from Toronto. The transit consolidated cargo is first registered as Vancouver traffic, then is broken and railed to Toronto as individual shipments, where it is registered again as Toronto traffic.

The implications of sea-air cargo growth

The implications of sea-air growth to the Airport Authorities, Port Authorities, airlines, shipping lines, sea-air operators and freight forwarders are found in Tables 18 and 19 that follow:

1. From Vancouver Airport, as a percentage of total international air cargo exports to the rest of the world.

2. To Vancouver Port, as a percentage of total import container traffic and tonnage

Table 18. From Vancouver Airport
(in 1000 tons, rounded to the nearest 100)

	1990	1991	1992	1993	1994
Total cargo handled	121	124	131	151	181
Total domestic cargo	74	72	70	91	115
Total international cargo[1]	47	52	61	60	66
Total air exports[2] *(including sea-air)*	20	27	24	22	24
Total sea-air volume	9	9	9	9	9
Sea-air % of total	**45.0%**	**33.3%**	**37.5%**	**40.9%**	**37.5%**

Source : Airports Council International - Airport Traffic Statistic, 29 March 1995 and Airport Traffic ICAO Digest of Statistic No. 403 - 1992 and No. 410, ICAO 1994 - 11/94 Q/P1/1600.

Notes:
1. *Air imports and air exports.*
2. *Total air exports world wide.*

Table 19. To Vancouver Port
(in 1000 tons & containers, rounded to the nearest 100)

	1990	1991	1992	1993	1994
Total container traffic[1]	323	384	441	430	425
Import container traffic	161	182	221	215	212
Sea-air containers	4	4	4	4	4
Sea-air % of total[2]	**2.5%**	**2.2%**	**1.8%**	**1.9%**	**1.9%**
Total container tonnage	2,708	3,290	3,624	3,570	3,450
Import container tonnage	1,354	1,645	1,812	1,785	1,725
Sea-air container tonnage[3]	23	23	19	19	20
Sea-air % of total[4]	**1.7%**	**1.4%**	**1.0%**	**1.1%**	**1.2%**

Source : ISL Shipping Statistics Yearbook of 1993 and relevant Port Authorities' direct releases March 1995.

Notes :
1. *Total container traffic = total off-loaded and loaded. Containers offloaded at any port are the property of shipping lines and must be re-exported, whether empty or loaded with cargo. Therefore 50% of the total containers handled by any port represent import cargo, and the balance is re-exported to origin. Thus, a container is handled twice at any port.*
2. *Sea-air container percentage of total is reached by applying number of sea-air containers to the number of import containers. example; in 1990, 2.5% is reached by dividing (4 + 161) x 100 = 2.5%.*
3. *Sea-air container tonnage : Sea-air cargo is largely low dense volume and high value cargo, and occupies larger container space with lower weights. Freight Forwarders, Sea-air operators and Port Authorities in Taipei, Hong Kong and Singapore confirm that the average sea-air load per 20' container (TEU) ranges between 4.5 and 5 tonnes. Sea-air container tonnage includes sea-air cargo diverted to other than Vancouver Airport, from the Port of Vancouver.*
4. *Sea-air container tonnage percentage of the total is reached by dividing import container tonnage by sea-air container tonnage x 100. The same computation is applied throughout this chapter.*

In summary;

1. The Port of Vancouver is able to handle a greater number of containers and container tonnage. In 1994, it handled 425,000 containers and 3.5 million tonnes of containerised cargo which represents 85% of its present container terminal capacity. With the scheduled opening of its new container terminal in late 1995, the container terminal facilities will double the present capacity of 500 thousand containers to one million.

2. The Airport of Vancouver, with a current airline cargo capacity of 29,500 tonnes per annum (Appendix E-1), is approximately 30% utilised by sea-air cargo originating in the Port of Vancouver in 1990; this rate of utilisation remained unchanged through 1994, while domestic air exports grew from 11,000 tonnes in 1990 to 15,000 tonnes in 1994, thus utilising slightly over 50% of available cargo capacity per year (Table 18, page 62). This means that approximately 80% of total available air cargo capacities was utilised in 1994. Only 20% or 4,500 tonnes of air export cargo capacities remain unutilised - a case that does not pressure Vancouver Authorities to offer additional facilities to the parties involved. However, this unutilised cargo capacity is further enhanced by the air cargo capacities from mainly Toronto Airport and to a lesser extent, from Montreal Airport.

   Toronto is connected by an efficient and reliable railway system from the Port of Vancouver, that has been successfully used for sea-air cargo. Total air exports, including sea-air cargo averaged 43,000 tonnes[1] per year (1990 - 1994), against available cargo capacity of 71,100 tonnes (Appendix E-2), a utilisation rate of 60%. 40% or 28,000 tonnes remain unutilised, a figure almost equal to all available air export capacity from Vancouver Airport.

   From Montreal, air exports averaged 59% over the same period, against an available air export capacity of 50,600 tonnes (Appendix E-3). 40% or 20,700 tonnes remain unutilised from Montreal Airport.

This presents a compelling reason for the Vancouver Port Authorities to ease their rigidity by offering additional facilities and incentives to shipping lines, freight forwarders, NVOCCs and sea-air operators.

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1. Source : Airports Council International - Airport Traffic Statistic, 29 March 1995 and Airport Traffic ICAO Digest of Statistic No. 403 - 1992 and No. 410, ICAO 1994 - 11/94 Q/P1/1600.

5.2 The sea-air route via Seattle

During the 1980s, Seattle and Tacoma emerged as one of the leading sea-air transfer hubs of the world. Specifically, the period between 1985 and 1992 witnessed the introduction of new freighter services to Europe. In addition, several major freight forwarders established operational bases in the Seattle area. As a result, Far East sea-air operators started recommending the route via Seattle as a reliable option, to their clients. Short total transit time, low cost and reliability attracted major forwarders in Japan, South Korea and Taiwan to use the Seattle route on a regular basis. In the late 1970s and early 1980s, air cargo space was limited from SEA-TAC airport to Europe. It consisted mostly of belly space on passenger flights and the indirect service by Flying Tiger via their hub to Europe.

The scene was different on the ocean segment. Most shipping lines calling at Vancouver were calling first at Seattle or Tacoma. The frequencies of shipping services were numerous. Further, the shorter sailing time (one day less than Vancouver), together with the efficiency derived from priority handling of sea-air containers by Seattle port, resulted in a very fast transit time from port to airport. This is what made Seattle Port ready to assume its future role as one of the leading sea-air transfer ports of the world.

Table 20: **Seattle Port**

Analysis of container traffic

Tonnage:in thousands. Containers: in thousands

Port	1987	1988	1989	1990	1991	1992	1993[1]	1994[2]
Seattle Port								
Total no. of containers handled.	964	951	964	1,063	1,049	1,053	1,059	1,311
Total container tonnage	7,135	7,290	7,262	7,773	7,999	7,794	8,019	9,866
Containerisation degree (% of general cargo)	**95.4%**	**95.6%**	**94.9%**	**94.4%**	**92.1%**	**94.1**	**93.5%**	**93.3%**
Av. tonnage/container	**7.4**	**7.7**	**7.5**	**7.3**	**7.6**	**7.4**	**7.6**	**7.5**

Source : Port of Seattle Container and Tonnage Reporting Statistics system. Faxed by Seattle Port Authority to the researcher in May 1995.

Table 21: **Tacoma Port**

Analysis of container traffic

Tonnage:in thousands. Containers: in thousands

Port	1987	1988	1989	1990	1991	1992	1993[1]	1994[2]
Tacoma Port								
Total no. of containers handled.	697	782	925	938	1,021	1,054	1,075	1,028
Total container tonnage	4,353	5,170	5,986	5,986	6,440	6,712	6,712	6,440
Containerisation degree (% of general cargo)	**47.0%**	**37.0%**	**38.0%**	**41.0%**	**50.0%**	**56.0%**	**59.0%**	**62.0%**
Av. tonnage/container	**6.2**	**6.6**	**5.6**	**6.4**	**6.3**	**6.4**	**6.2**	**6.3**

Source : Port of Tacoma Container and Tonnage Reporting Statistics system. Faxed by Tacoma Port Authority to the researcher in May 1995.

The Port of Tacoma is cited in Table 21, page 64, as an alternative to Seattle Port, in cases of congestion. Because of its high sensitivity to transit time, all sea-air cargo is handled by Seattle Port on a priority basis. Intermodal transport, in general, is delayed by half to a full working day, at Tacoma Port, because all container traffic (save the part destined to Portland, which is directly railed), is hauled deep inland to Spokane Terminal for segregation or assembly, and then re-distributed to final destination, either by rail or trucks.

The growth of air cargo capacities from Seattle airport had to wait until late 1983, when Cargolux airline introduced a B747 once weekly freighter service to Seattle from Luxembourg[1]. It continued to add more capacity to this market with two flights per week in 1985, which was increased to three flights per week in 1988, culminating in five flights per week in 1990. This frequency was stabilised at four regular flights per week, between 1992 and 1993, and later reduced to three flights per week in 1994 and is forecasted to be upgraded to four flights per week, as from 1996 onward.

The development did not go unnoticed by other airlines, and a DC 10[2] weekly freighter service was soon established by Martinair of Holland in 1985, and a few years later a weekly B 747 freighter service was introduced by UTA of France. These three freighter operators were the main providers of freighter capacity for sea-air cargo from Seattle to Europe, till 1991 and early 1992, when UTA decided to suspend its services, thus limiting freighter cargo capacities to that provided by only the two remaining freighter airlines for the rest of the period under analysis, until the end of 1994.

This development induced a strong growth in direct and indirect support services from passenger airlines, such as British Airways, SAS, Finnair, United and Pan Am[3], who participated in carrying sea-air cargo in their bellies. Support service also came from freight forwarders and the trucking industry. The cargo flown from Seattle to Europe was not all sea-air. There were strong exporting industries in the Pacific North West area, such as the Seattle based Boeing aircraft industry and many other computer based industries. Seattle Airport made its own estimates as to how big a portion of the exports were of local origin vs the uplift of sea-air cargo. These estimates are tabulated in Table 22, page 66.

1. Cargolux operates a trucking service from Luxembourg to almost all international airports of Northern Europe, with daily frequencies. Therefore, Luxembourg gradually became a re-distribution overland hub for all sea-air cargo carried from Seattle to various destinations in Northern Europe via Luxembourg (Source: Interviews with Cargolux Regional Managers, Sept. 1992 and Nov 1994).

2. Martinair upgrades its once weekly service to B747 during certain times of the year when the season is high for cargo, i.e. from September to December 10, and from March to end July each year.

3. Pan Am filed Chapter 11 (Bankruptcy procedures) in 1990.

Table 22: Sea-air cargo from SEA-TAC Airport vs local exports
(in 1000 metric tonnes)

	1988	1989	1990	1991	1992	1993	1994*
Local Exports	4.9	5.2	7.2	7.8	8.2	8.0	8.1
Sea-air exports	15.8	17.4	19.6	16.8	15.3	15.3	13.0
Sea-air share of the total	76.3%	77.0%	76.3%	68.3%	65.1%	65.7%	61.6%

Source: Seattle Airport Authority. * *1994 figures are estimated.*

Interviews with the airlines using Seattle Airport revealed the following figures of air cargo movement from Seattle airport to Europe. The figures were rounded to the nearest 100 tonnes (fractions over 50 tonnes were rounded to 100, and those below 50 tonnes were ignored).

Table 23 : Total air cargo, Seattle to Europe
(in metric tonnes)

Airline	1989	1990	1991	1992	1993	1994*
Cargolux	13,300	15,500	14,100	13,900	13,700	10,000
Martinair	2,600	3,200	3,000	2,800	2,800	2,700
SAS	2,800	2,900	3,000	3,000	3,000	2,200
British Airways	1,100	1,400	2,400	2,200	2,100	2,700
UTA/Air France	300	900	1,300	-	-	-
Others	2,500	2,000	800	1,600	1,700	1,600
Total	22,600	26,800	24,600	23,500	23,300	21,100

Source: Seattle Airport Authority. * *1994 figures are estimated.*

Note: The figures in this Table show the bulk of sea-air cargo was transported by only a handful of air carriers, actually shifting to specialised sea-air carriers rather than spreading among many airlines. This is evident as the figures under 'Others' (other air carriers), share shrunk from 2,500 tonnes in 1989 to a meagre 800 tonnes in 1991 and picked up again in 1992, 1993 and 1994, to stabilise at 1,600 tonnes. The carriers grouped under 'Others' were Pan Am, United, Northwest and Finnair. Most US carriers considered sea-air cargo as undesirable simply because of its low returns. They therefore did not show keen interest in this particular traffic.

Total air freight export traffic figures to Europe (Table 23, above) show that the year 1990 witnessed an increase of 13.7% over 1989, while 1991 figures show a decrease of 4.3% from 1990, with a declining trend developing through 1992 and 1993, culminating in the lowest figure ever of an estimated 21,100 tonnes in 1994. Further, it becomes very clear from Table 24, page 67, that the bulk of sea-air cargo was handled by a few airlines.

The decrease in sea-air cargo volume handled by Seattle Airport was mainly attributed to the decreasing air cargo capacities made available by the air carriers due to the directional imbalance of air cargo traffic, between Europe and Seattle. Many carriers calling on Seattle Airport were forced to reduce their freight frequencies, or even suspend them, such was the case of UTA of France in early 1992.

The percentage market shares of the most dominant carriers were as follows:

Table 24 : Air cargo, Seattle to Europe
(percentage share)

Airline	1989	1990	1991	1992	1993	1994*
Cargolux	58.8%	60.3%	57.3%	59.1%	58.8%	47.4%
Martinair	11.5%	12.5%	12.2%	11.9%	12.0%	12.8%
SAS	12.4%	11.3%	12.2%	12.8%	12.9%	10.4%
British Airways	5.0%	5.0%	9.8%	9.4%	9.0%	12.8%
UTA of France	1.8%	3.5%	5.3%	-	-	-
Others	10.5%	7.4%	3.2%	6.8%	7.3%	7.6%
Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Source: Derived from Table 23 - Seattle Airport Authority.
** 1994 figures are estimated.*

The Port of Seattle applied priority handling for sea-air cargo arriving in containers during the 1980s and early 1990s. Container vessels from the Far East increased their frequencies and scheduled their arrival dates into Seattle Port. Sea-air cargo from the Far East (Japan, South Korea and Taiwan) was booked on container vessels with scheduled arrivals into Seattle Port on certain days of the week, to meet scheduled air freighter services from Seattle airport to various destinations in Europe.

APL has for some time played a leading role in carrying sea-air cargo to the Pacific Northwest. Their arrival time in Seattle was on Friday, giving just enough time to make the transit to the majority of cargo flights, which depart Seattle during the Saturday - Monday period (Martinair has their once weekly flight on Sundays, while the four Cargolux flights depart Saturday, Sunday, Monday and Wednesday).

With a shift in the ship arrival from Friday to Saturday, making the Saturday flight connection no longer possible, a Sunday flight departure becomes very tight, as most cargoes which missed the Saturday freighter were rebooked on Sunday's flight. NYK and Hyundai scheduled their arrivals into Seattle Port on Wednesdays. As such, sea-air containers were transferred to the airport, destuffed and rebuilt into air pallets, ready for air carriage on the same day Wednesday or latest by Thursday. But airlift to Europe had to wait till Saturday's freighter service, which meant a precious 3 to 5 days loss of transit time from port to airport.

Table 25, below, shows the arrival day of ships at Seattle Port from the Far Eastern countries of Japan, South Korea and Taiwan.

Table 25: Container vessels serving SEA-TAC from the Far East
Average trip duration in days taken from shipping lines schedules in 1990 - 1991 - 1992.

Shipping line	Day of arrival Seattle or Tacoma	Journey duration in days from	
		Japan	S. Korea/Taiwan
APL	Sat	9	10
Hyundai	Wed	9	10
K Line	Mon	8	10
Mitsui OSK	Mon	9	10
NYK Line	Wed	9	10
NOL	Mon	9	10
OOCL	Mon	9	10
Sea-Land	Sun	8	10
Maersk Line	Sun	9	10

Source: Seattle Ports Authority

As this table shows, most of the vessels arrive in Seattle or Tacoma during the period Saturday - Monday, which happens to be the same time period when the majority of the freighter services depart SEA - TAC for Europe. However, Wednesday arrivals of Hyundai and NYK shipping lines result in 3 - 5 days of port to airport transit time, a fact that prolonged the total transit time, and presented a clear disadvantage to the continuity and growth of sea-air cargo flow. To overcome this particular disadvantage, freight forwarders and other sea-air operators started an immediate search for other options that would reduce the 3 - 5 days stay time.

Not all shipments were flown from Seattle Airport within the first 48 hours of having arrived at the port. Transit times via Seattle were affected by arrival day of the vessel vs day of flight departure. The connection possibilities determined the additional transit time. The importance of the connection possibilities between vessel arrival and flight departures is highlighted further in Table 26, page 69:

Table 26 : Sea-air schedule connection and transit time 1990 - 1991 - 1992

Arr day of vessel	Shipping line	First cargo flight out	Dep day	Dwell time in Seattle
Sunday	Maersk Sea-Land	Cargolux	Mon	1 day
Monday	K-Line Mitsui OSK NOL OOCL	Cargolux	Wed	2 days
Wednesday	NYK Line Hyundai	Cargolux Martinair UTA Cargolux	Sat Sun Sun Sun	3 days 4 days 4 days 4 days
Saturday	APL	Cargolux Martinair UTA Cargolux	Sun Sun Sun Mon	1 day 1 day 1 day 2 days

Source: Seattle Ports Authority

Therefore, the number of connections offering one day transit are limited and very tight. A safe connection is a two day connection, which can be obtained by a Monday ship arrival and Wednesday flight departure, and a Saturday ship arrival, with Monday flight departure.

The concentrated operation of cargo aircraft frequencies around the weekend was primarily due to the availability of cargo from Europe to the US at the end of the week. Traditionally the freight forwarders in Europe consolidate their air export freight for two large moves per week, one in the middle of the week, and another during the weekend. The objective with the weekend move was to fly out on Saturday or Sunday from Europe, a European week's production of goods, and make it available for customs clearance at the destination point on Monday morning.

The outbound cargo flights offered in the Seattle market were in fact dictated by the demand from Europe. Seattle air exports to Europe exceeded its air imports, thus causing the well known directional imbalance in air cargo traffic flow (Table 27, page 70).

Table 27 : Directional imbalance : Seattle vs Europe
(figures to the nearest 100 tonnes)

Year	Import	Export	Imports as % of Exports
1989	09,8	22,6	43.3%
1990	10.6	25,7	41.0%
1991	09,1	24,6	37.0%
1992	09,1	23,5	38.3%
1993	08,7	23,3	37.3%
1994*	08,0	21,1	37.9%

Source: Airline reports to Seattle Port.
* *1994 figures are estimated.*

This situation has forced airlines to either combine a Seattle flight with another city on the inbound segment (adding to cost), or to pass some of the cost of the light revenue inbound flight to the outbound. The findings of the period under analysis for the sea-air market between 1989 and 1994 do in fact set the scene for very limited growth in the sea-air volume via Seattle Airport. Available air cargo capacities depend largely on the North American demand, and specifically that of the Seattle area, for European products. Thus an increase in air freight demand for European products helps balance the directional imbalance of freight movement.

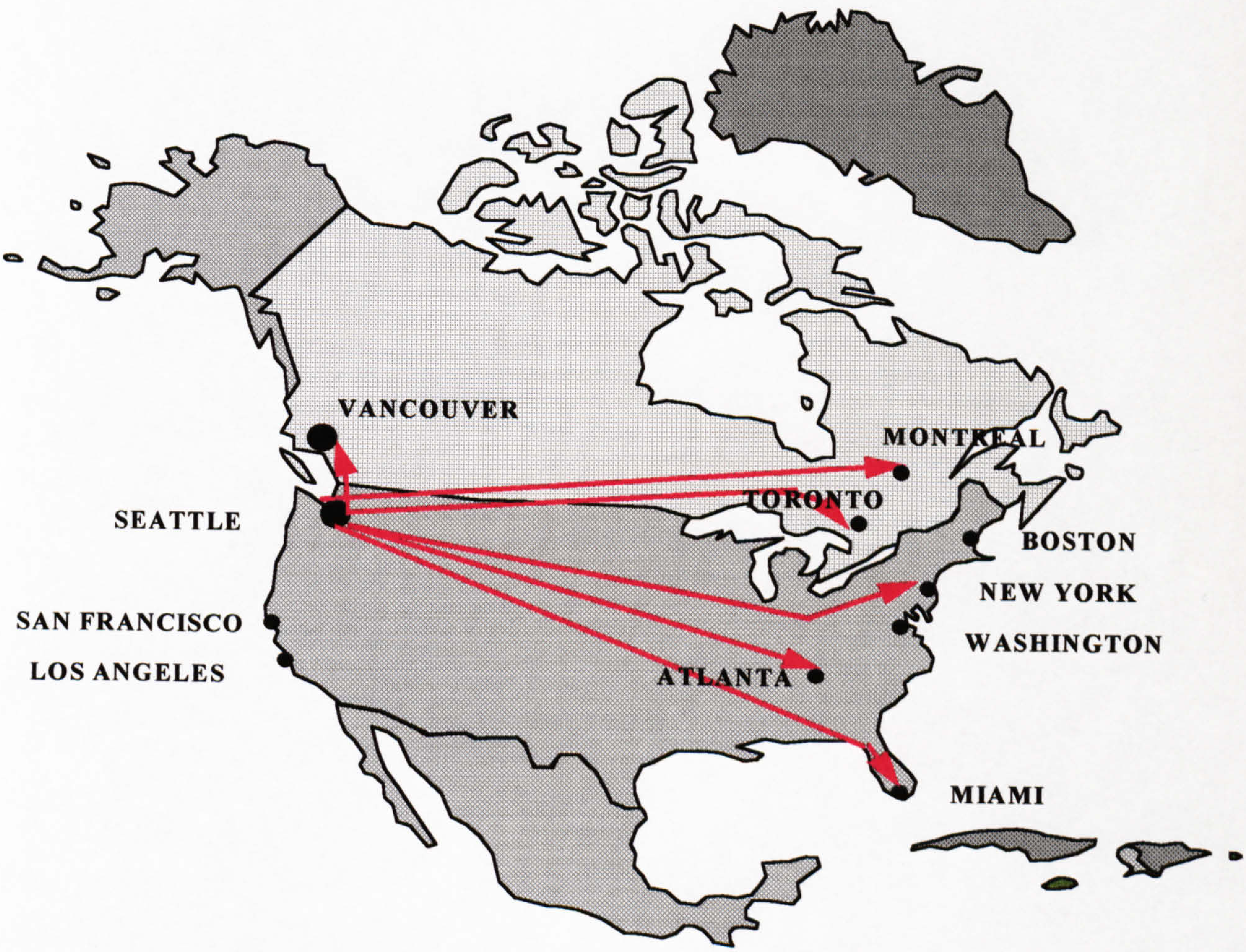
Appendix E-4, compiled in September 1994, shows that the only carrier offering regular freighter flights from Seattle was Cargolux, while Martinair upgrades during the season, a once weekly freighter service, usually on weekends. The rest operate a mixed configuration of passengers and cargo. The available cargo capacities (Fedex discounted) was 27,300 tonnes in 1994. A declining trend of available air cargo capacity started in 1990 and continued through the 5 year period that followed, resulting in a continuous yearly decrease of total air cargo tonnage carried. As compared with each year, 1994's figure of 21,100 tonnes of total air cargo traffic carried to Europe represented:

a decrease of 21.8 % from 25,700 tonnes in 1990
" 16.6 % from 24,600 tonnes in 1991
" 11.4 % from 23,500 tonnes in 1992
" 10.4 % from 23,300 tonnes in 1993

This implies that the trend of cargo capacities from Seattle Airport to Europe was not that of growth but that of a gradual decline over the five year period, ending in 1994. However, whatever air cargo capacity was made available on pure freighter flights, during any one year it was assumed to have been fully utilised, and excess cargoes diverted to other airports in North America.

Options of trucking the containers to Canadian airports deep inland, such as Toronto and Montreal Airports, entailed 3 and 5 days overland journeys, while in the case of Vancouver Airport, only 3 trucking hours were required. Further, motives of lower air freight rates helped the move to haul cargo overland to other airports, not only in Canada, but also within America, where air cargo capacities to Europe were available at lower rates (refer Appendices E-2 and E-3, on available cargo capacities from Toronto and Montreal, and Appendices E-5, E-6, E-7, E-8, E-9 and E-10, on available air cargo capacities from American Airports such as Atlanta, Boston, Miami and New York.).

Figure 13 : Route Diversion *(trucking from Seattle)*



A report was prepared by Seattle Port Authorities late in 1992, in an attempt to quantify the sea-air market. 15 major freight forwarders and sea-air operators in the Seattle area, were interviewed, and figures on sea-air cargo diversion by overland transport (truck/rail) to other airports, were derived for the years 1990, 1991 and the first half of 1992. For the second half of 1992, 1993 and the first half of 1994, approximate figures were derived by the researcher through direct contact with 6 major Seattle based, sea-air operators. Table 28, below, shows the best estimates of sea-air traffic via the Port of Seattle.

Table 28 : Routing diversion of sea-air cargo
arriving at the Port of Seattle and Tacoma
(all figures in tonnes)

	Air Carriage via				
Years	**Seattle**	**Miami**	**Canada**	**Other US Airports**	**Total**
1990	19,600	7,000	25,500	7,700	59,800
% of total	32.8%	11.7%	42.6%	12.9%	100.0%
1991	16,800	6,500	21,500	15,100	59,900
% of total	28.0%	10.9%	35.9%	25.2%	100.0%
1992	15,300	9,000	26,300	4,100	54,700
% of total	28.0%	16.5%	48.1%	7.5%	100.0%
1993	15,300	10,300	25,800	4,900	56,300
% of total	27.2%	18.3%	45.8%	8.7%	100.0%
1994*	13,000	10,900	27,300	5,800	57,000
% of total	22.8%	19.1%	47.9%	10.2%	100.0%

Source: *Seattle Airport Authority/ Researcher's direct contact with Seattle based Sea-Air Operators, Oct. 1994.*
Notes : * *1994 figures are estimated. 1990 and 1991 totals are relatively high due to the diversion of U.A.E. sea-air traffic to North American transfer hubs as a result of the Arab Gulf crisis.*
Canada:Vancouver, Toronto, Montreal. Other US airports:NewYork, Atlanta, Boston.

As seen in this Table, an average of 44% (of a five-year period 1990 - 1994) of total cargo flow into Seattle Port, was trucked to Canadian airports, for further air lift to Europe. The above numbers include an adjustment factor of 5% on the total, and are rounded up to the nearest one hundred tonnes. The adjustment is made in order to allow for the tonnage that moved via Seattle/Tacoma by smaller forwarders, which may have been missed. In summary, available air cargo capacities from Seattle Airport are gradually declining because many European air carriers are facing difficulties in balancing the directional imbalance in traffic flow, as North American demand for European made products is dwindling and being replaced by products of the Asia-Pacific region, forcing carriers such as UTA and Air Canada to suspend their freighter services in early 1992 from Seattle and Vancouver Airports, respectively.

The windfall increases of 1990-1991 due to the Gulf War and the subsequent shift of 40,000 tonnes of sea-air traffic from the U.A.E route to the North American route, did in fact inflate the growth rate via Seattle, Los Angeles, and Miami, periodically. As Seattle assumed a share of approximately 25%, or 10,000 tonnes, of this windfall, a proper account of the normal growth could only be considered starting from 1992, or else, the 1990-1991 figures must be adjusted to show the sea-air volumes less the 10,000 tonnes windfall for each year. In both cases, Table 8, page 72, shows a steady increase of sea-air cargo via Seattle-Tacoma port as of 1992, and this is mainly attributed to:

a) the full awareness of Seattle Port Authorities of the importance of attracting as much cargoes as possible, including sea-air cargo, to their port, by offering a wide variety of facilities such as computerised state of the art information and communication systems, and many other attractions as detailed in the next chapter.

b) the growing trend of the support services offered by other airports in North America, such as Toronto, Atlanta, Boston, Miami and New York, was developed by European air carriers in their attempts to rationalise their international services by consolidating flights to major high volume cargo routes in North America. Such was the case of Lufthansa which consolidated its international flight services from points in Germany to New York, Atlanta, Los Angeles, Boston, Miami etc, thus cutting the costs of operating its multi-international services and using the few major high volume points as a re-distribution centre to various smaller regional points in North America, either by overland transport, or via the regular and dense domestic air services. This practice was immediately followed by many major European airlines such as British Airways, KLM and many others. This practice was reversed by the North American carriers who, contrary to any rationale, adopted a policy of multiple flight frequencies to almost all the gateway airports of Europe. Their argument is that their marketing efforts are focused on passenger traffic and they would want to offer their passengers a direct service to the nearest airport to their residence in Europe.

Appendices E-5 to E-10, show the average annual air cargo capacities made available from Atlanta, Boston, Miami and New York to main gateway airports in Europe. The stress on European carriers is made because of their interest in developing sea-air traffic, as fill-in cargo, despite its average low return. On the other hand, direct interviews with North American carriers, on the Regional Manager level, conducted in 1992, 1993 and mid-1994 were discouraging, in so far as sea-air traffic was concerned. They did not show any real interest in carrying this particular traffic, due to its marginal revenues, and preferred to concentrate their efforts on high value, high yield goods produced by their region's industry and marketed partly for distribution by air to various points within North America, and partly air exported to Europe and the rest of the world.

The emergence of cargo hubs gave rise to the phenomenal development of overland diversion to and from the selected air cargo re-distribution centres. This fact boosted the efforts of Seattle Port Authorities to attract more sea-air cargo to their port and which was promptly diverted overland to these newly established hub airports. This practice of overland diversion was mainly due to the relatively high air freight rates to Europe, and the limited air cargo capacities offered from Seattle Airport, which at present handles less than 25% of total sea-air traffic passing through the Port of Seattle (Table 28 page 72).

An appreciable part of Seattle Port's sea-air cargo is not air freighted from Seattle Airport due to the relatively high air freight rates applicable to Europe. For example, Seattle market air cargo rates have recently[1] ranged between US$ 1.60 and US$ 1.80 per kilogram. On the other hand, from Atlanta, rates were available on a prime time Lufthansa freighter service to Frankfurt, at around US$ 1.25 to US$ 1.30/kilogram. The saving of 35 to 55 cents per kilogram was more than enough to absorb the 3 to 5 days of overland diversion time and cost. In view of the much lower rates offered from these airports to various European destinations, freight forwarders and sea-air operators were able to offer shippers and consignees the option of a lower total transport cost at a marginally longer total transit time.

The implications of sea-air cargo growth to the Airport and Port Authorities, airlines, shipping lines, sea-air operators and freight forwarders are found in Tables 29 and 30, that follow:

1. From Seattle Airport, as a percentage of total international air cargo exports to the rest of the world.
2. To Seattle Port, as a percentage of total import container traffic and tonnage.

Table 29. From Seattle Airport
(in 1000 tons, rounded to the nearest 100)

	1990	1991	1992	1993	1994
Total cargo handled[1]	245	193	282	381	415
Total domestic cargo	200	149	239	322	355
Total international cargo	45	44	43	54	60
Total air exports *(including sea-air)*[2]	27	25	24	23	21
Total sea-air volume	20	17	15	15	13
Sea-air % of total	**74.0%**	**68.0%**	**62.5%**	**65.2%**	**61.9%**

Source : Airports Council International - Airport Traffic Statistic, 29 March 1995 and Airport Traffic ICAO Digest of Statistic No. 403 - 1992.
Notes : 1. Total cargo handled = loaded and offloaded between Seattle Airport and the rest of the world.
2. ICAO Digest of statistics No. 410, ICAO 1994 - 11/94 Q/P1/1600. Total air exports worldwide.

1. Figures in this paragraph were derived from interviews with Seattle based airline managers, sea-air operators, freight forwarders and quotes by airlines operating from Atlanta between Mar - Aug 1994.

Table 30. To Seattle Port
(in 1000 tons & containers, rounded to the nearest 100)

	1990	1991	1992	1993	1994
Total container traffic[1]	1,063	1,049	1,053	1,059	1,311
Import container traffic	532	525	527	530	656
Sea-air containers	13	13	12	13	13
Sea-air % of total[2]	**2.4%**	**2.5%**	**2.3%**	**2.4%**	**2.0%**
Total container tonnage	7,773	7,999	7,794	8,019	9,866
Import container tonnage	3,887	4,000	3,897	4,010	4,933
Sea-air container tonnage[3]	60	60	55	56	57
Sea-air % of total[4]	**1.5%**	**1.5%**	**1.4%**	**1.4%**	**1.2%**

Source : ISL Shipping Statistics Yearbook of 1993 and relevant Port Authorities' direct releases March 1995.
Notes: 1, 2, 3 and 4 same computation as in Tables 18 and 19 under Vancouver section 5.1.

In summary, the Port of Seattle's current handling of 1.3 million boxes and 9.9 million tonnes of container tonnage, can be expanded greatly. As seen in Table 20, page 64, from 1987 to 1989, the total number of containers handled, and its tonnage, remained stagnant at slightly less than a million boxes, at 7.3 million tonnes per year; while during 1990 - 1994, the number of boxes handled, rose by over 200,000, on average, per year, and its tonnage to almost 10 million tonnes, i.e. a growth of 20% in container traffic and 30% in container tonnage.

The potential of the Port of Seattle is to grow substantially during the next five year period and this is bound to affect sea-air cargo flow positively through Seattle Airport and the other North American supporting airports such as the main airports of Canada and the US; namely Miami, Atlanta, Boston and New York who, in fact, represent huge supporting air cargo capacities.

US Airports	Available air cargo capacities p.a. to Europe (Appendices E-5 to E-10)
Seattle	27,300 tonnes
Atlanta	55,100 tonnes
Boston	57,200 tonnes
Miami	86,600 tonnes
New York	391,800 tonnes
	618,000 tonnes

In addition, much use was made of major Canadian airports (Table 28, page 72) to move volumes of sea-air cargo. The Port of Seattle currently handles an average of 57,000 tonnes of sea-air cargo per annum, 16,000 of which is handled by Seattle Airport, while an average of 41,000 tonnes are handled by other supporting airports of North America.

The important conclusion is: Despite the limited availability of air cargo capacity from both Vancouver and Seattle Airports, sea-air intermodality continued its healthy growth through overland diversions to other airports within North America, where air cargo capacity was available at lesser or similar to Seattle airline rates. The healthy growth is demonstrated through the ability of sea-air intermodality to absorb the additional monetary costs and longer transit time resulting from overland diversions.

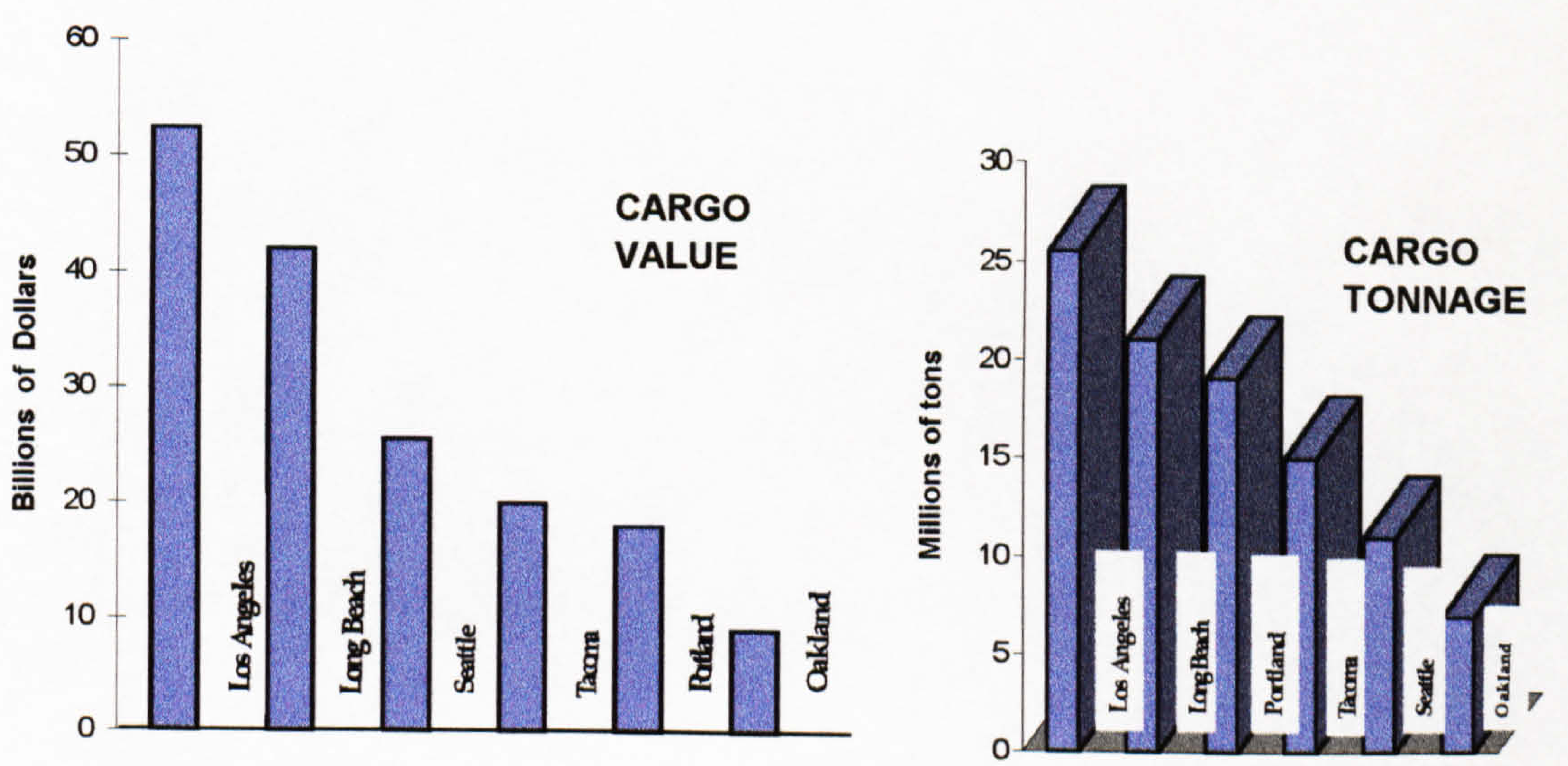
5.3 The sea-air route via Los Angeles

An introduction to the ports of Los Angeles

The ports of Los Angeles (Worldport LA) and the Port of Long Beach were first developed in 1542 on a natural harbour site. Today the two ports have facilities to cater to nearly 200 vessels at the same time. General cargo tonnage totals approximately 50 million tonnes annually, making these two ports the busiest in the United States.

In 1994, Worldport LA led all U.S. West Coast ports in foreign cargo volume and value; handling in excess of 25 million tons of goods worth more than US$ 50 billion. The port surpassed its nearest regional competitor in cargo traffic by one-half million tons and cargo value by nearly US$ 6 billion.

Figure 14 :



Source: WorldPort LA and Long Beach Port Authorities' Statistics 1994

The success of Worldport L.A. and Long Beach Ports is attributed to many factors, the most important are:

Strategic location

Positioned on the western edge of the West Coast of the United States, it forms an attractive option for flows of high volume traffic from the Pacific region, namely countries such as Japan, Korea and Taiwan. Focus for these ports extends beyond the traditional Pacific region area, to Europe, South America and Africa.

Transport Network

The important aspect of any port's competitive position is its ability to serve through an efficient overland transport network. By road, Worldport and Long Beach are served by two motorways, 'the Harbour motorway' and 'the Terminal Island motorway', which connect three major Interstate routes. Interstate 5 runs from the Canadian border near Vancouver down the US West Coast through Washington, Oregon and California, and crosses the Mexican border south of San Diego. Interstate 10 is the main east/west link running from Los Angeles through Arizona, New Mexico and Texas, to Florida.

Interstate 15, taking a north-easterly route from Los Angeles, accesses Nevada, Utah, Idaho, Montana and Canada. The Interstates provide the ports the possibility to serve all areas, specified above, by road alone. Road transport, however, does not provide the most efficient mode of transport.

Rail transport offers the most fuel efficient and environmental friendly form of transport. The two ports are serviced by three major trans-continental railroads (Southern Pacific Transportation Co. and Atchison, Topeka and Santa Fe Railway Co).

Each of the trans-continental railroads interchange directly with other US, Mexican and Canadian railroads, thus providing cargo moving through the two Los Angeles ports access to over 250,000 miles (402,325 km.) of main rail trackage.

As for air freight, three major airports service Worldport and Long Beach:

Los Angeles Airport (LAX) - one of the largest and most important airports in the US, offering 1,800 flights daily and is serviced by 85 airlines (including fourteen all cargo airlines). Volumes of air cargo movement in excess of 1.5 million tonnes is handled (loaded/offloaded) annually.
Ontario Airport - although smaller than LAX, is important, handling 5 million passengers and 300,000 tonnes of cargo per year. This airport specialises in passenger and cargo traffic within the USA and is basically termed as a domestic airport.

Van Nuiys Airport - the busiest general aviation airport in the US, with approximately 500,000 aircraft movements yearly. This airport specialises in charters and smaller passenger aircraft movements from Los Angeles to any point in the U.S.A.

Handling facilities

To compete for traffic flows, any major port's handling facilities should be able to ensure the shortest possible transit time to intermodal cargo flow. Therefore, in order to obtain a competitive edge, facilities at both Worldport and Long Beach are constantly being upgraded, expanded and new facilities constructed.

Table 31: Worldport LA and Long Beach
Analysis of container traffic
Tonnage:in thousands. Containers: in thousands

Port	1987	1988	1989	1990	1991	1992	1993[1]	1994[2]
Los Angeles								
Total no. of containers	1,585	1,652	2,108	2,116	2,038	2,090	2,100	2,123
Total container tonnage	28,530	29,901	38,365	40,204	38,722	36,875	37,800	38,214
Containerisation degree (% of general cargo)	**71.0%**	**71.4%**	**84.4%**	**80.0%**	**77.5%**	**71.5%**	**74.5%**	**77.1%**
Av. tonnage/container	**18.0**	**18.0**	**18.0**	**18.2**	**19.0**	**18.0**	**18.0**	**18.0**
Long Beach								
Total no of containers	1,460	1,485	1,545	1,637	1,617	1,838	1,940	1,987
Total container tonnage	26,280	26,670	27,877	29,865	30,674	34,703	37,181	39,388
Containerisation degree (% of general cargo)	**88.0%**	**88.6%**	**89.0%**	**90.1%**	**89.9%**	**90.9%**	**91.2%**	**91.4%**
Av. tonnage/container	**18.0**	**18.0**	**18.0**	**18.2**	**18.9**	**18.9**	**19.2**	**19.8**

Source : *ISL Shipping Statistics Yearbook, Institute of Shipping and Logistics (ISL), Bremen, October 1993 and direct contact with the relevant Port Authorities.*

Notes : *Figures 1987 to 1992 were derived from ISL Yearbook 1993.*

1. & 2 : *Figures for 1993 and 1994 were derived from related periodicals and tested against ISL figures, and average percentage changes per year over six years (1987 - 1992) - periodicals such as the ICHCA Annual Review, World of cargo handling, London, March 1995.*

The importance of expanding and improving Port facilities is further highlighted in a general 1994 report on sea-borne trade by UNCTAD (United Nations Conference on Trade and Development), which forecasts a 50% increase in world sea-borne trade, to 5 billion tonnes per year. Various factors are involved in this forecast.

1. Increased consumer demand for imported goods from Korea, Japan, Taiwan and China. The trade between these countries and the US is expected to continue its dramatic increase, as it has already done over the last decade.

2. Expected changes in the world political map, such as the dissolution of the Soviet Union, and the emergence of East European countries, will inevitably bring profound changes to the pattern of world trade.
3. The North American Free Trade Agreement, embracing the US, Canada and Mexico, is expected to offer unrivalled development opportunities leading to a surge in North-South trade along the North American West Coast.
4. The economies of Central and South America are forecast to grow substantially in the next two decades.

To cope with the anticipated growth, Worldport LA launched the largest development project since its founding in 1907. The '2020' project when completed will constitute the largest integrated marine - highway - rail transportation system, introducing new high efficiency terminals and facilities comprising more than 100 acres of new land created by extensive outer dredging.

Construction of the 150,000 lifts-a-year Terminal Island Container Transfer Facility (TICTF) is expected to be operational in 1995, and the container handling installations planned will also feature a Container Transfer Facility at each site. Another element of project '2020' named the Alameda corridor should greatly enhance the transfer of truck traffic to rail. It will cover a 25 mile route connecting the port with major rail facilities in downtown Los Angeles.

Parallel developments are taking place at the airports of Los Angeles. The 98 acre cargo complex has recently been upgraded to provide for speedy round-the-clock handling of air cargo.

In addition, the city's Department of Airports is investing US$ 50 million (1994) in a new 57 acre Imperial Complex which will offer state-of-the-art air cargo facilities. Further, several private air carriers and freight forwarders have started their own newly built air cargo facilities. A new airport covering 17,500 acres is under construction to cope with increasing demand, and will be named Palmdale Regional Airport.

The sea-air cargo market of Los Angeles

Sea-air cargo via Los Angeles was initiated by the airlines (Flying Tiger and United Airlines) in the late 1950s and early 1960s for practically the same reasons that applied to other sea-air transfer ports of the US west coast. The main purpose was to 'fill in' unutilised air cargo capacities that were available to points in Central America and the East Coast of America, to Europe and South America. A large portion of high value goods was attracted to this mode from the then, all ocean, long journeys of 35 to 45 days.

Despite the introduction of new technology and fast container ships, the ocean journey from Japan, South Korea and Taiwan to

Central and Northern Europe is still consuming an average of 30 to 35 days, because of the many ports of call en route. Ocean services to South America are slow and unreliable[1], especially to the many large landlocked markets in that part of the world.

Ocean journeys from the Far East to South America, including transfer of containers to South American shipping lines at Los Angeles or Miami, take an average of 45 days even until the present day in 1994.

Results of field research, interviews and questionnaires in Los Angeles, with the ports and airport authorities, were similar to those of Seattle, Vancouver and San Francisco. No official statistical support on sea-air cargo movements was available. However, interviews with shipping lines, airlines and freight forwarders were more productive in terms of data required.

In 1989, as a result of the growing awareness of the potential of the sea-air cargo market, Worldport Los Angeles and Los Angeles Airport Authorities started a committee that met regularly to discuss how that particular market is developing. The increased attention to this issue, as from 1989 onward, may be almost entirely credited to the Los Angeles Port and Airport Authorities' awareness of the strength of sea-air traffic via Seattle-Tacoma.

Based on a market survey conducted and co-ordinated by Mr. Rick Wells, Assistant Chief of Planning, Los Angeles Airport, informal figures on the size of the market were published in an in-house memorandum circulated among the managers of Los Angeles Airport in November 1989. The survey was done strictly with the airlines serving Los Angeles Airport. 43 questionnaires were sent out to 43 airlines, of which 24 responded positively.

Airport officials estimated total sea-air tonnage flow from Los Angeles Airport in 1988 to have been 7,200 tonnes, broken up as follows:

5,200 tonnes to Europe,
1,000 tonnes to US domestic destinations and
1,000 tonnes to South America.

The memo goes on to state that sea-air cargo is considered by U.S. airlines to be 'not desirable cargo due to its low return'. It states further, that the Los Angeles area, contrary to Seattle, is a huge origin-destination market for direct air freight, and therefore the capacity for sea-air cargo to influence Los Angeles traffic volumes is minimal, and that there was no need to embark on extensive marketing of the sea-air product.

Field research and intensive analysis of official figures released to the researcher (in response to a written request) by Los Angeles Airport Authorities, as tabulated by the U.S.

1. A detailed analysis of unreliability is presented under Miami as a major transfer port to South America (Section 5.5 in this chapter).

Department of Commerce, Bureau of the Census, IN145 and EM545, dated March 1995, show accurate and official data of air imports and domestic air exports to/from Los Angeles airport, for a period of five years, starting from 1990 to 1994, covering the following regions:

1. West Europe
2. East Europe
3. South America

In addition, official data was released by Los Angeles Airport Authorities, showing cargo handled by all airlines, using Los Angeles Airport, between 1990 and 1994. Los Angeles Airport, similar to other relevant sources such as ICAO and IATA, records only a single statistical figure of cargo handled, i.e covering two operations of cargo tonnage weights loaded and off-loaded, and do not record separate figures for each of the two operations. The analysis that follows, based on certain practical assumptions, is a serious attempt by the researcher to determine the present status of Los Angeles Ports and Airports, air and ocean carriers, in relation to intermodal transport, and specifically sea-air cargo movement. The attempt goes further to substantiate the current sea-air cargo volume, as a whole and per airline, in figures that were denied, or said to be classified, or were reported as 'unavailable' by the shipping lines, airlines, port and airport authorities.

The sea-air traffic between Los Angeles Airport and Europe:

As total domestic made air exports and air imports tonnage by country has been released by the Department of Commerce (tabulated in Appendix F-2), and since total tonnage handled (loaded and offloaded) by air carriers at Los Angeles Airport was also released by the Los Angeles Airport Authority (tabulated in Appendix F-1), then, subtracting total imports from total cargo handled yields gives the total tonnage of air exports from Los Angeles Airport.

Since all transit cargo, originating in the Ports of Los Angeles, and air exported through its airports, is not recorded by the Department of Commerce, the air export total tonnage figure, from Los Angeles Airport, was much greater than that reported by the Department of Commerce. The excess must be considered as transit sea-air cargo.

Total cargo handled at Los Angeles Airport between Los Angeles and Europe was 183,000 tonnes in 1994. Subtracting air imports of 52,300 tonnes results in 131,000 tonnes of total air exports. Domestic air exports to Western Europe were 78,300 tonnes and to eastern Europe, 2500 tonnes, a total of 80,800 tonnes. Therefore sea-air tonnage was 131,000 less 80,800= 50,200 tonnes.

The US carriers' confirmed lack of interest in carrying sea-air cargo means that they only carried domestic air exports. It is further assumed that the US carriers share 50% with participating

European carriers on this route, as they are unable to have a larger share due to their limited air cargo capacity of 50,500 tonnes per annum (Appendix F-3) to Europe. 50% of 80,800 tonnes is 40,400 tonnes, resulting in a freight load factor of 80% [(40,400 ÷ 50,500) x 100].

The European carriers were left with 50,200 tonnes of sea-air cargo volume and 40,400 tonnes of domestic air exports, totalling 90,600 tonnes, to be spread among their combined available capacity of 135,800 tonnes, including El Al airline (Appendix F-3). The tonnage share per airline was computed according to an axiom that the tonnage share performed is directly proportional to its percentage share of total available capacity to Europe. Example: British Airways availed an annual average cargo capacity of 17,600 tonnes versus a total available of 135,800 tonnes. Therefore, British Airways percentage share of tonnage performed is 13% of 90,600 tonnes of total available tonnage = 11,800 tonnes. The percentage share and tonnage performed by 12 major airlines in 1994, is computed below:

Table 32. Scheduled European airlines' share distribution, from Los Angeles Airport to Europe total air exports and sea-air volumes in tonnes (1994)

Airline	% share	Total air exports tonnage performed	Sea-air tonnage	Available capacity
British Airways	13.0%	11,800	6,200	17,600
Lufthansa	11.5%	10,500	7,800	15,700
Air France	13.8%	12,500	8,200	18,700
Alitalia	13.8%	12,500	2,100	18,700
Cargolux	11.4%	10,400	10,200	15,600
KLM	6.0%	5,500	4,600	8,200
Virgin Atlantic	5.9%	5,300	3,100	8,000
El Al	10.8%	9,800	4,000	14,700
Lauda	4.3%	3,900	---	5,900
Swissair	3.3%	3,000	2,000	4,500
Martinair	1.8%	1,700	1,700	2,500
Iberian	2.8%	2,300	---	3,500
Others	1.6%	1,500	300	2,200
Total	100%	90,600	50,200	135,800

Source: Column 2, total air export tonnage performed, including sea-air. Column 3, sea-air tonnage; is a 'best estimate' figure drawn by the researcher from direct interviews with the airlines and freight forwarders in Los Angeles area. Column 4, available capacity as tabulated in Appendix F-3.

The development of sea-air cargo volumes and their percentage share of total air exports to Europe, over the five year period under review, is shown in Table 33, page 83.

Table 33. Sea-air cargo share to Europe from Los Angeles Airport

	1990	1991	1992	1993	1994
Local air exports to Western Europe[1]	77,200	81,300	95,600	83,300	78,300
Local air exports to Eastern Europe[2]	900	900	1,700	2,700	2,500
Total local air exports to Europe	78,100	82,200	97,300	86,000	80,800
Sea-air	57,600	49,500	31,200	31,500	50,200
Total air cargo to Europe	135,700	131,700	128,500	117,500	131,000
Sea-air % share	**42.4%**	**37.6%**	**24.3%**	**26.8%**	**38.3%**

Source : Los Angeles Airport Authority official release of cargo tonnage handled per airline operating scheduled services from Los Angeles Airport and Department of Commerce official release of domestic made exports and imports from and into Los Angeles Airport.

Almost all air freight export movement from Los Angeles Airport to Europe is carried at present by twenty four major carriers. Field research, interviews and the analysis made earlier show that only 10 European carriers were interested in carrying sea-air cargo, while the other 14 did not show any interest, due mainly to its low returns. Sea-air cargo was important to many European carriers such as British Airways, Air France, KLM, Lufthansa, Virgin Atlantic, Swissair, Alitalia, Cargolux, Martinair and El Al, as sea-air cargo has been a major revenue factor and represented 38.3% of their respective total cargo uplift in 1994.

As seen in Table 33, above, sea-air cargo generated 42.4% of the total air cargo exports in 1990. From then onward, in 1992 and 1993, it dropped sharply to 24.3% and 26.8% respectively. The reason for the 1990 higher-than-average share was mainly due to the Gulf crisis, and the consequential transfer of all U.A.E. bound sea-air cargo, to the West Coast hubs of North America and to Singapore.

Los Angeles sea-air market to South America

The flow of sea-air cargo for South America via Los Angeles Airport has grown strongly with indications for much further and stronger growth to occur during the last decade of the 20th century.

The research finding confirms that sea-air cargo to South and Central America grew from 19,000 tonnes in 1990 to 25,000 tonnes in 1991 and more than double that figure in 1994 at 51,100 tonnes, despite the fact that most of the cargo destined for Mexico is usually trucked over from the Port of Los Angeles or Long Beach. But due to the difficulties of truck clearance congestion at the borders next door to San Diego (Tijuana), a good portion of this cargo is at present air-carried to Mexico.

To trace the development of sea-air cargo volumes to South and Central America, including the air portion carried to Mexico from Los Angeles Airport, the same method of analysis used for Europe is used again here, covering a five year period starting 1990 to 1994. Before 1990, sea-air cargo to South and Central America was negligible and within the 1000 tonnes bracket.

1. Appendix F-4, shows total air cargo capacities made available by all scheduled international carriers operating between Los Angeles Airport and South, Central America and Mexico.
2. Appendix F-5, shows total air cargo handled (loaded/offloaded) by all airlines operating between Los Angeles Airport and South, Central America and Mexico.
3. Appendix F-6, shows total Los Angeles air exports (domestic made exports) as released by the US Dept, of Commerce, Bureau of the Census, of March 1995, to major countries in South America.
4. Appendix F-7, shows total exports and imports, and the ratio of exports of total trade between Los Angeles and major South American countries.

The first step is to determine the total air exports, including sea-air cargo carried, by subtracting the total air imports from total air cargo handled (loaded and offloaded). The second step is to determine the total sea-air volume by simple deductions of Los Angeles' domestic air exports from the total air exports (Table 34 below).

Table 34. **Sea-air cargo share**
to South and Central America (incl. Mexico)
from Los Angeles Airport

	1990	1991	1992	1993	1994
Total local air exports	8,100	8,900	11,200	11,500	13,300
Total Sea-air	19,100	25,100	38,500	43,200	50,100
Total air cargo to S. & C. America	27,200	34,000	49,700	54,700	63,400
Sea-air % share	**70.2%**	**73.8%**	**77.5%**	**80.0%**	**79.0%**

Source : *Los Angeles Airport Authority official release of cargo tonnage handled per airline operating scheduled services from Los Angeles Airport and Department of Commerce official release of domestic made exports and imports from and into Los Angeles Airport.*

The figures in Table 34, page 84, show a dramatic annual growth rate in sea-air cargo volumes of :

+ 31.4% in 1991
+ 53.4% in 1992
+ 12.2% in 1993
+ 16.0% in 1994

The interesting fact here is that sea-air cargo is a very important revenue factor for almost all the airlines operating from Los Angeles Airport to South and Central America, as it constitutes an average of 75% of all air cargo traffic.

Overland Truck Feeder Services :

Overland truck feeder services from Los Angeles Airport are provided by the airlines operating from/to the airport, under official City of Los Angeles licences. The airlines that operate feeder trucking services are :

1. Scandinavian Airways.
2. Swissair
3. Federal Express
4. Link America
5. Airmax

The first three operate their own trucking services, with Federal Express concentrating on their very own special high revenue traffic of express parcel deliveries, with no contribution to sea-air cargo movements, while Link America and Airmax are commissioned by other airlines interested in moving sea-air cargo to other US Airports for further on-carriage, by air, to destinations they serve. This is largely due to the saturated cargo capacities of these airlines from Los Angeles Airport.

Link America : is a small airline based in Chicago and licensed to operate feeder trucking services, like any other airline from/to the airports, and cannot, by law, offload or load cargo from any other place as the cargo is moving 'inbond' onboard their trucks.

Airmax : is also a small airline, based in St. Louis, Missouri and Chicago and licensed to operate feeder trucking services, like Link America.

The nature of sea-air cargo is that it moves 'in bond' from ports to airport and is not registered as revenue cargo to the US Customs and Excise Departments, and therefore it must not be off-loaded anywhere enroute except at the airport to which it was first consigned, as per Bill of Lading of the shipping line.

Airlines at the airports receive sea-air cargo through the assistance of Freight Forwarders and shipping lines who deliver, direct to the airport, full container loads or de-consolidated container loads, in smaller independent shipments, each with a different destination.

The handling of containers by the Ports of Los Angeles and Long Beach shows that the average load per container is approximately 18 tonnes (Table 31, page 78). This may be due to the large consumer area of Los Angeles which caters to 14 million consumers. As such, orders are usually huge and occupy a large number of bigger capacity containers. This means that most containers handled by these two ports are 40 foot containers, which in the case of sea-air, are delivered to Los Angeles Airport 'in bond' and are registered by the Los Angeles and Long Beach Port Authorities, and not the Airport Authorities, to avoid duplication. As this cargo is delivered to the airline at the airport, part or all of it may find its way onto international flights, and, therefore, is registered by Los Angeles Airport as cargo handled by the airline concerned. Part of this cargo may be diverted through truck feeder services, or through commissioned airlines who operate such a service, and, therefore, is not registered by Los Angeles Airport.

Feeder truck services are provided and publicised with certain set and authorised frequencies per week to certain destination airports within the U.S. The frequencies can be upgraded or downgraded depending on demand by the principal airline. Research and interviews with the airlines operating these services revealed that no downgrading takes place, all frequencies are executed as published and publicised, even at lower than average payload. They may be delayed, but not cancelled. Upgrading takes place, usually during the high season starting June 15th, up to mid October, when a return to original standard frequency schedules takes place.

The average payload per truck is approximately the same as the container loads handled by both ports of Los Angeles and Long Beach, i.e. 18 tons per 40 foot container. In cases of full container loads, the same ocean container cargo is offloaded, segregated per destination and reloaded onboard feeder truck trailer services, either air- palletised or as is in bulk.

Communications between the airline, the truck feeder service, the airport of delivery, airline office, Airport Authorities and the US Customs and Excise Dept. in tracking shipments and computer tallying of entry and exit shipments moving 'in bond', is adequate and efficient. Cargo moving on truck feeder services between airports in the US is fully insured against total or partial loss and/or damage, and the liability of the airline operating such a service is an extended liability of its international air freight flight services covering the invoice value of the consignment with a ceiling on compensation to shipper or consignee, not to exceed US$ 20.00 per kilogram. In cases where the declared value of the consignment exceeds the set limit of US$ 20 per kilogram, and the shipper wishes to insure the declared value, then an additional premium covering value in excess of the set limit is levied from the shipper as 'valuation charge', and is clearly inserted on the relevant box of the CTD (Combined Transport Document), and/or the airline's Airway Bill, whichever is applicable, at the very origin of the shipment, i.e.

Japan, Korea, Taiwan and the Far East in general.

Feeder trucking services are operated mainly by those airlines who are interested in carrying 'fill in' cargo as it contributes to their revenue. From Los Angeles Airport to airports within the US, the following truck feeder services operated by various airlines are listed, with an estimated cargo tonnage made available at the re-routed (diverted to) airports for on-carriage to final destination by air.

1. Los Angeles/Atlanta

a. Swissair operates seven truck frequencies per week, all carrying air palletised cargo, with an average of 18 tonnes per truck load, which means approximately 6,500 tonnes of sea-air cargo to Atlanta, for further on-carriage to Zurich on their four weekly combi flights, B74D LPQ and two 743 LPJ and one M11 LPJ (Appendix F-3)

b. Airmax operates two feeder trucking services per week, carrying an average of 150 tonnes of air palletised sea-air cargo per truck trip. This service is upgraded to an additional frequency as of June 15th each year till Oct 15th or 20th, i.e. 20 additional frequencies per year, which means a total of approximately 2,000 tonnes per year (124 frequencies x 15 tonnes).

c. Link America operates seven feeder trucking services per week all carrying de-palletised or bulk cargo at an average of 17.5 tonnes per truck trip, yielding a total load of 6,400 tonnes per year.

2. Los Angeles/Boston

a. Airmax operates two regular frequencies per week and upgrades during the season with an additional 20 frequencies spread over five months. All frequencies carry air palletised cargo which averages at about 2,000 tonnes per year (124 frequencies x 15 tonnes).

b. Link America operates seven regular trucking frequencies per week, carrying de-palletised cargo, or breakbulk, at an average of 17.5 tonnes per truck trip. Total tonnage averages 6,400 per year.

3. Los Angeles/San Francisco

a. Scandinavian Airlines operates seven air-palletised cargo trucking services to San Francisco for further on-carriage by air to Scandinavia, mainly Helsinki. Total average tonnage = 6,500 tonnes per year.

b. Airmax and Link America both operate regular weekly seven air-palletised cargo services and seven bulk cargo services with both, together, averaging 11,800 tonnes per year. This cargo is largely import cargo from Europe with San Francisco as its final destination. European airlines who are restricting their frequencies to high volume routes and do not operate multiple frequencies to nearby airports (San Francisco is only 500 miles from Los Angeles Airport), in their attempt to reduce operating costs, resort to truck feeder delivery services, of consignments, to their nearby airport of final destination.

4. Los Angeles/Miami

a. Airmax operates 2 regular air-palletised cargo truck frequencies per week, and upgrades during the 5 month high season with 3 additional frequencies, at a total tonnage of 3,700 tonnes per year (164 frequencies x 15 tonnes).
b. Link America operates five regular bulk cargo trucking frequencies per week, and upgrades to seven frequencies during the high season. The approximate total tonnage carried to Miami by Link America is 5,200 tonnes per annum (300 frequencies x 17.5 tonnes).

The total sea-air volume that was moved in 1994 through feeder trucking services was as per the following Table.

Table 35. Sea-air cargo route diversion to feeder truck service
from Los Angeles Airport (in tonnes)

	1990	1991	1992	1993	1994
Atlanta	3,600	5,200	11,000	12,500	14,900
Boston	2,000	2,900	6,200	7,100	8,400
San Francisco	1,600	2,300	4,800	5,500	6,500
Miami	1,600	2,300	4,800	5,500	8,900
Total	**8,800**	**12,700**	**26,800**	**30,600**	**38,700**

Source : *Derived from interviews with freight forwarders, airlines and airlines operating trucking services from Los Angeles Airport.*

The figures for the years 1990 to 1993 were computed according to the percentage growth of sea-air cargo per year, over the preceding year and tested against the feeder services' capacities and frequencies that were available each year, starting in 1990. These figures were checked again during interviews with the major Los Angeles based freight forwarders who confirmed that the above figures were accurate and reflect actual sea-air movements within a margin of ± 7% variation.

In summary, the sea-air market via Los Angeles Airport during the period of five years under review, between 1990 and 1994 can be described as follows:

1. To Europe :

Growth is limited to the air cargo capacities made available by those airlines interested in sea-air cargo. The present imbalance of trade between Los Angeles air exports in relation to air imports to and from Europe makes it difficult for airlines to operate additional freighter services. Table 36, below, shows a wide imbalance of air imports in relation to air exports.

Table 36. **Los Angeles /Europe**
Air exports vs, air imports
and imports as a % of exports

	1990	1991	1992	1993	1994
Exports	77,200	81,300	95,600	83,300	78,300
Imports	38,600	39,100	42,000	45,600	52,300
Imports as a % of exports	50.0%	48.1%	43.9%	54.1%	66.8%

Source : US Dept. of Commerce, Bureau of the Census.

Starting as low as 50% in 1990 and worsening even more during the next two years that followed, to 48.1% and 43.9% respectively, air imports started to improve in 1993 to reach 54.1% of air exports, and reached its highest ratio in 1994 of 66.8%.

Increased freighter capacities cannot be economically justified through the dense carriage of air cargo on only one sector and especially when that cargo is largely sea-air and produces much less revenue to the airline concerned.

The only possibility for air cargo capacities to increase between Europe and Los Angeles lies in balancing the present directional imbalance of trade, i.e. by increased air imports into Los Angeles Airport, a case which is not likely to happen in the near future.

Air exports to Europe are almost stable at an average of 80,000 tonnes a year, while air imports have steadily risen from 38,600 tonnes in 1990 to 52,300 tonnes in 1994 making an average of 43,400 tonnes per year, which is slightly higher than 50% of the air exports.

Sea-air cargo to Europe does not represent any attraction to the US carriers, whose share is concentrated on the domestic air exports' higher returns; therefore the possibilities of growth in sea-air cargo bound for Europe lies basically in the overland feeder services to alternative airports in the US, where air cargo capacities are available in abundance.

The growth of sea-air to Europe via alternative airports is seen in Table 37, page 90.

Table 37. The growth of sea-air cargo to Europe
via Los Angeles Airport direct air
and through feeders via alternative US Airports
and the percentage share of each

Year	LAX Airport Direct	Atlanta feeder service	Boston feeder service	SFO feeder service	Total
1990	57,600	3,600	2,000	1,600	**64,800**
% of total	*88.9%*	*5.6%*	*3.1%*	*2.5%*	*100%*
1991	49,500	5,200	2,900	2,300	**59,900**
% of total	*82.6%*	*8.7%*	*4.8%*	*3.8%*	*100%*
1992	31,200	11,000	6,200	4,800	**53,200**
% of total	*58.6%*	*20.7%*	*11.7%*	*9.0%*	*100%*
1993	31,500	12,500	7,100	5,500	**56,600**
% of total	*55.7%*	*22.1%*	*12.5%*	*9.7%*	*100%*
1994	50,200	14,900	8,400	6,500	**80,000**
% of total	*62.8%*	*18.6%*	*10.5%*	*8.1%*	*100%*
5 yr total	**220,000**	**47,200**	**26,600**	**20,700**	**314,500**
Average per year	**44,000**	**9,440**	**5,320**	**4,140**	**62,900**

Source : Compiled, computed and tabulated from Tables 34 and 35 on pages 84 and 88 respectively.

2. To South and Central America :

On this route the situation is reversed. Air imports exceed air exports by a much bigger margin.

Table 38. Los Angeles / South & Central America
Air exports vs, air imports
and imports as a % of exports

	1990	1991	1992	1993	1994
Exports	2,500	2,800	4,900	4,700	6,100
Imports	4,400	5,200	6,600	8,000	9,400
Imports as a % of exports	176.0%	185.7%	134.6%	170.2%	154.0%

Source : US Dept. of Commerce, Bureau of the Census.

This means that sea-air cargo has ample room to grow substantially to South and Central America as 'fill in' cargo to the current unutilised air cargo capacities made available through the directional imbalance of trade in favour of air imports. The increase will continue until it reaches the point where all available unutilised capacities are fully utilised and saturated.

Sea-air cargo may witness further growth through the added facility of Miami Airport (through truck feeder services) where unlimited and unutilised air cargo capacities are made available increasingly through the hundreds of flights that land daily at Miami Airport fully loaded with fresh produce from South and Central America, to cater to the dramatic growth of Miami's and Florida's consumer market, which is largely made up of people of Latin American origin, who maintain close ties with their original home countries (Table 39, below).

Table 39. The growth of sea-air cargo to South and Central America
via Los Angeles Airport direct air and through feeders via Miami Airport and the percentage share of each

Year	via LAX Airport direct	via Miami	Total
1990	19,100	1,600	**20,700**
% of total	*92.3%*	*7.7%*	*100%*
1991	25,100	2,300	**27,400**
% of total	*91.6%*	*8.4%*	*100%*
1992	38,500	4,800	**43,300**
% of total	*88.9%*	*11.1%*	*100%*
1993	43,200	5,500	**48,700**
% of total	*88.7%*	*11.3%*	*100%*
1994	50,100	8,900	**59,000**
% of total	*84.9%*	*15.1%*	*100%*
5 yr total	**176,000**	**23,100**	**199,100**
Average per year	**35,200**	**4,620**	**39,820**

Source : Compiled, computed and tabulated from Tables 34 and 35 on pages 84 and 88 respectively.

The implications of sea-air cargo growth to the Airport Authorities, Port Authorities, airlines, shipping lines, sea-air operators and freight forwarders are found in Tables 40 and 41 that follow:

1. From Los Angeles Airport, as a percentage of total international air cargo carried to the rest of the world.
2. To Los Angeles Port, as a percentage of total container traffic and tonnage.

Table 40. **From Los Angeles Airport**
(in 1000 tons, rounded to the nearest 100)

	1990	1991	1992	1993	1994
Total cargo handled	1,165	1,141	1,230	1,326	1,545
Total domestic cargo	752	718	750	843	1,048
Total international cargo	413	423	480	493	497
Total air exports *(including sea-air)*	192	201	222	221	224
Total sea-air volume	77	75	70	75	100
Sea-air % of total	**40.1%**	**37.3%**	**31.5%**	**33.9%**	**44.6%**

Source : *Airports Council International - Airport Traffic Statistic, 29 March 1995 and Airport Traffic ICAO Digest of Statistic No. 403 - 1992.*

Table 41. **To Los Angeles Port**
(in 1000 tons & containers, rounded to the nearest 100)

	1990	1991	1992	1993	1994
Total container traffic	2,116	2,038	2,090	2,100	2,123
Import container traffic	1,058	1,019	1,045	1,050	1,061
Sea-air containers	19	19	22	23	31
Sea-air % of total	**1.8%**	**1.9%**	**2.1%**	**2.2%**	**2.9%**
Total container tonnage	40,204	38,722	36,875	37,800	38,214
Import container tonnage	20,102	19,361	18,438	18,900	19,107
Sea-air container tonnage	86	87	97	105	139
Sea-air % of total	**0.04%**	**0.04%**	**0.05%**	**0.06%**	**0.07%**

Source : *ISL Shipping Statistics Yearbook of 1993 and relevant Port Authorities' direct releases March 1995.*

A closing remark on Los Angeles Ports and Airports:

The wide range of facilities offered by the Los Angeles Ports and Airports, shipping lines, airlines, freight forwarders and sea-air operators, make Los Angeles a convenient alternative to Seattle and Vancouver.

Sea-air cargo uplifted from Los Angeles airport arrives at two ports in the metropolitan area, similar to the Seattle-Tacoma situation. Nearly all shipping lines serving Seattle-Tacoma from the Asia Pacific region also serve the Los Angeles market, but most of them on clearly differentiated routing networks. Many of them operate newer technology, faster ships to Los Angeles, than they do to the Pacific Northwest, and can offer a sailing time from the Far East to Los Angeles that exceeds the sailing time to Seattle and Tacoma by only one day (or a total of 10 days vs 9 days to Seattle-Tacoma).

An added advantage is that ship arrivals are not as concentrated around the weekend, as in the case of the Pacific Northwest. The spread of shipping lines' arrivals to the ports of Los Angeles (Worldport) and Long Beach, over all the days of the week, make it possible for sea-air cargo to connect all airline weekly frequencies, regardless of whether they fall at the weekend or not, a fact that improves on the daily flight payload increasing the utilisation of unutilised capacities, which otherwise remain (in other sea-air transfer hubs) unutilised during mid week flights, thus improving airline freight load factors and thereby improving revenues.

Based on these findings, Los Angeles Airport officials were not quite correct in concluding that the sea-air market is not of as great a significance to Los Angeles Airport as it is to Seattle. The analysis, contrary to Los Angeles Airport Authorities' convictions, confirms the importance of sea-air cargo to this airport.

5.4 The sea-air route via San Francisco

Sea-air cargo traffic via San Francisco was started by Flying Tiger in the early 1960s. At the time, and until the mid 1970s Flying Tiger was moving sea-air cargo by air mainly to the US East coast and Central America. The timely introduction of the double-stacked container trains had a devastating effect on this particular sea-air movement, by attracting almost all the sea-air volume to the railways who offered scheduled timely departures and arrivals, at comparatively very low rates, due to the double stacking of containers.

The sea-air market to Europe and South America, as from the mid 1970s onward, showed a slow but steady increase; the slowness of sea-air cargo growth was mainly attributed to the limited air cargo capacities that were made available by the limited airlines operating international scheduled services between San Francisco Airport and the main gateway airports of Europe. However, starting from the early 1980s onward, airlines operating this sector increased their flight frequencies with extensive use of wide-bodied aircraft, which resulted in a substantial increase of available air cargo capacities to Europe, while international scheduled airlines' services to South and Central America had a very limited growth, and consequently, air cargo capacities were limited to the very few airlines who operated wide-bodied aircraft on this sector.

Before 1990, sea-air cargo volume to Europe and South America was limited to approximately 3,500 tonnes per year. The figures released by the US Bureau of the Census, Water Borne and Commerce Department, show that sea-air volume was:

3,426 tonnes in 1988
1,168 tonnes in 1989
and approximately 5,000 tonnes in 1990.

Therefore any serious attempt to analyse and quantify the sea-air market via San Francisco Airport must take into consideration the following data, over a specific period of time :

1. Air cargo capacities made available from the Airport through airline frequencies and type of aircraft designated use.
2. Port container handling activity and shipping lines' frequencies.
3. Total air cargo volumes carried to Europe and South America.
4. Total local San Francisco air exports.

To start with, the period to be reviewed is taken from 1990 to 1994. A five year period analysis should be able to present, quite fairly, the position of San Francisco Port and Airport in relation to sea-air cargo movements, its development trends and the future prospects of growth.

Air cargo capacities : San Francisco/Europe

European air carriers operate 52 frequencies per week to very few European gateway airports. Thus, general flight services are concentrated at five airports, which by themselves generate high volumes of cargo movement on the route, as opposed to the US carriers multiple flight frequencies to ten gateway airports, which naturally results in the spreading of the load, and therefore lower cargo volumes per flight. European and US carriers' frequencies from San Francisco Airport to main gateway airports in Europe is detailed in Appendix F-8.

The general trend of the US carriers has been stated before, and is repeated here again to spotlight it as one of the main factors responsible for the continuous and persistent, low freight load factors of the North American carriers. The US carriers operating from San Francisco, or any major US airport, except Los Angeles and Miami, unlike the Europeans, adopt a policy of multiple flights to multiple gateway airports in Europe. US carriers operating from Los Angeles and Miami are geared to apply this policy to South and Central America, and consolidate their frequencies to Europe to only seven major gateways, in the case of Los Angeles and four in the case of Miami, as against 15 and 9 respectively by the Europeans (Appendices F-3 and G-1).

From San Francisco, the US carriers' argument is: since they have the least interest in moving low return sea-air cargo, and since their concentrated marketing efforts are mostly focused on passenger traffic, and the high return domestic air exports of San Francisco and part of the strong air export market of Seattle (computers and the Boeing aircraft aviation industry spare parts, etc.), they would want, therefore, to offer a direct air service to their passengers, shippers and consignees located in the areas around the airport of destination; unlike the European airlines who resort to domestic airline services and overland feeder truck services to re-distribute their passengers and cargo from their major gateway hubs to various destinations in Europe.

One may not be surprised to see so many major American carriers filing Chapter 11 (bankruptcy procedures) during the last decade. Such was the case of Pan Am and TWA (Trans World Airlines), while Flying Tiger, America's and the world's No. 1 freighter airline, was facing survival difficulties, and was sold to Federal Express, a freight forwarder.

The lack of interest of the US carriers in sea-air cargo is compensated by the keen interest of the European carriers, who enjoyed, for quite some time, the privilege of monopolising the carriage of this type of traffic, until early 1990, when they started facing competition by an outsider, a carrier that is neither European nor American, namely El Al, who with three B 747 freighter frequencies per week to Amsterdam applied a policy of priority loading to cargo bound for their home country; whatever balance air cargo capacity that becomes available is sold to sea-air operators through a 'spot rating' procedure - which eventually ends up with El Al carrying sea-air cargo to Amsterdam for further distribution to points in Europe at marginally lower rates than those applied by the European carriers.

The Port of Oakland and the shipping lines :

The same shipping lines calling at Seattle - Tacoma ports call at the Port of Oakland, with very few port calls to the Port of Portland, on their way to San Francisco Bay. The average transit time is only one day in excess of that of Seattle and Tacoma. Oakland is only half an hour by road to San Francisco Airport, and sea-air traffic to the airport, as well as rail traffic to the East Coast, is handled promptly and efficiently, with adequate handling equipment, similar in quality and productivity to those available in Long Beach Ports, Seattle - Tacoma and all West Coast ports of North America.

Table 42, below, shows the total number of containers handled by the Port of Oakland, the percentage of container tonnage in relation to general cargo tonnage and average load per container.

Table 42: **Oakland Port**

Analysis of container traffic

Tonnage:in thousands. Containers:in thousands

Port	1987	1988	1989	1990	1991	1992	1993[1]	1994[2]
Oakland								
Total no. of containers	954	1,032	1,091	1,124	1,195	1,291	1,360	1,525
Total container tonnage	12,360	12,673	12,807	13,387	14,495	18,100	19,500	20,800
Containerisation degree (% of general cargo)	**93.1%**	**94.3%**	**95.2%**	**96.5%**	**97.3%**	**98.0%**	**98.0%**	**98.0%**
Av. tonnage/container	**13.0**	**12.3**	**11.7**	**11.9**	**11.2**	**14.0**	**14.3**	**13.6**

Source : ISL Shipping Statistics Yearbook, Institute of Shipping and Logistics (ISL), Bremen, October 1993 and direct contact with the relevant Port Authorities.

The relevance of Table 42 to our analysis lies in the degree of containerisation and the number of containers handled per year, which means that the more air cargo capacities made available from San Francisco Airport, the more sea-air growth and the less diversion to other alternative airports.

Total air cargo carried to Europe :

Total air cargo handled (loaded/offloaded) at San Francisco Airport during the period under review, between 1990 and 1994, showing international cargo movement, is as per Table 43, below.

Table 43. Total cargo handled (loaded/offloaded) at San Francisco Airport
for all international destinations
(in 1000 tons, rounded to the nearest hundred tonnes)

	1990	1991	1992	1993	1994
International cargo handled loaded/offloaded	217	213	191	210	224

Source : Airports Council International - Airport Traffic Statistic, 29 March 1995 and Airport Traffic ICAO Digest of Statistic No. 403 - 1992.

The international cargo movements show a very slow rate of growth from 217,000 tonnes in 1990 to 224,000 tonnes in 1994, which means less than a 5% increase over the 1990 figure.

Total domestic San Francisco exports, including the part trucked from Seattle and Boeing headquarters, showed also a very slow average growth of 1.1% per year, as per the Department of Commerce, Bureau of Census released figures of 1990 to 1994. Total air exports to Europe and the rest of the world fluctuated between 93,000 and 96,000 tonnes during the five year period under review.

The US carriers' share was estimated to reach 60% of the total local air exports due to the policy followed of operating international scheduled frequencies to a multiple of gateway airports in Europe, and hence the shippers preference of direct air delivery, as opposed to overland truck service, from a few gateway hubs in Europe. The shares are split, as shown in Table 44, on the following page.

Table 44. General Cargo movement analysis and sea-air cargo volumes
(in 1000 tons, rounded to the nearest 100)

	1990	1991	1992	1993	1994
Total local air exports[1]	92,900	93,400	95,800	94,100	93,200
a. US carriers' share	55,700	56,000	57,500	56,500	56,000
b. European carriers' share	37,200	37,400	38,300	37,600	37,200
SFO sea-air volume	6,400	11,000	20,100	27,500	27,000
Sea-air cargo diverted from LAX	1,600	2,300	4,800	5,500	6,500
Total sea-air cargo carried by European carriers	6,400	11,000	15,900	22,700	21,900
El Al	NA[2]	NA	4,200	4,800	5,100
Total air cargo exports	**99,300**	**104,400**	**115,900**	**121,600**	**120,200**

Source: US Dept. of Commerce, Bureau of the Census and computed and derived from Tables in this section.
1. Total local air exports to Europe and the rest of the world.
2. NA - Not available.

South and Central America :

Table 45. Freighters and mixed flights from San Francisco to major gateway hubs in South America
(Available average cargo capacities rounded to the nearest 100 tonnes)

Airline	A/C type	Days of the week flights operate	Cargo capacity per annum	Destination
American Airlines	767 LPJ	Daily	3,500	Asuncion
United Airlines	763 LPJ	Daily	2,800	Rio de Janeiro
American Airlines	767 LPJ	Daily	3,500	Sao Paulo
Total available cargo capacity per annum, San Francisco to major S. American gateways			*9,800*	

Source : Air Cargo timetable, Number 440, September 1994.

Sea-air cargo to South and Central America is negligible and is mainly handled by Los Angeles and Miami Airports. Table 45, above, shows that the US airlines are the only air carriers providing air cargo capacity to South and Central America and is quite limited to the B767 and B763 passenger flights, accommodating largely the San Francisco local air exports.

In 1994, total air cargo that was registered as handled air exports from San Francisco Airport to destination airports in South and Central America was as follows :

Mexico City	900 tonnes
Rio de Janeiro	300 tonnes
Guadalajara	400 tonnes
Guatemala City	40 tonnes
Puerto Vallarta	20 tonnes
San Jose Cabo	20 tonnes
Others	50 tonnes
	1,730 tonnes

Most of the cargo was trucked to Los Angeles Airport for further uplift to the above destinations. The above figures were reported by American Airlines and United who operate from San Francisco Airport and TACA, Mexicana, Air France, VARIG and VASP who operate from Los Angeles Airport, but received cargo at San Francisco Airport, and were compared with figures published by ICAO Statistics No. 410 and were found to vary only slightly with 1992 figures, and therefore were accepted as reliable.

The implications of sea-air cargo growth to the Airport Authorities, Port Authorities, airlines, shipping lines, sea-air operators and freight forwarders are found in Tables 46 and 47.

1. From SFO Airport, as a percentage of total international air cargo carried to the rest of the world.

2. To Oakland Port, as a percentage of total container traffic and tonnage

Table 46. From San Francisco Airport
(in 1000 tons, rounded to the nearest 100)

	1990	1991	1992	1993	1994
Total cargo handled[1]	516	607	603	616	687
Total domestic cargo	299	394	412	406	463
Total international cargo	217	213	191	210	224
Total air exports *(including sea-air)*[2]	98	102	107	111	109
Total sea-air volume	6	11	20	27	27
Sea-air % of total	**6.1%**	**10.8%**	**18.7%**	**24.35**	**24.8%**

Source : *Airports Council International - Airport Traffic Statistic, 29 March 1995 and Airport Traffic ICAO Digest of Statistic No. 403 - 1992.*

Notes : *1. Total cargo handled = loaded and offloaded between SFO Airport and the rest of the world.*
2. ICAO Digest of statistics No. 410, ICAO 1994 - 11/94 Q/P1/1600.

Table 47. **To Oakland Port**
(in 1000 tons & containers, rounded to the nearest 100)

	1990	1991	1992	1993	1994
Total container traffic	1,124	1,195	1,291	1,360	1,525
Import container traffic	562	598	646	680	762
Sea-air containers	2	3	5	6	6
Sea-air % of total	**0.04%**	**0.05%**	**0.08%**	**0.09%**	**0.08%**
Total container tonnage	13,387	14,495	18,100	19,500	20,800
Import container tonnage	6,694	7,248	9,050	9,750	10,400
Sea-air container tonnage	6	11	20	27	27
Sea-air % of total	**0.01%**	**0.02%**	**0.02%**	**0.03%**	**0.03%**

Source : ISL Shipping Statistics Yearbook of 1993 and relevant Port Authorities' direct releases March 1995.

5.5 The sea-air route via Miami

Cargo operations at Miami Airport date back to the 1930s when aviation pioneer Eddie Rickenbacher's Florida Airways air carried mail, freight and heavy packages to various points in the United States. In 1937, the first year during which cargo information was tabulated, approximately 181 tonnes of cargo was handled at the airport, in comparison with over 1.3 million tonnes in 1994.

Approximately 40% of all cargo travels in the bellies of passenger aircraft serving Miami Airport. The remaining 60% is transported by 63 carriers providing dedicated cargo service. Since 1937, more than 15 million tonnes of cargo were handled at Miami Airport. International traffic accounts for 80% of total freight handled at the airport (figures source: DCAD 1995).

Miami's potential to become the biggest sea-air hub in the world is supported by two main factors. Firstly, the availability of substantial cargo space to almost all major gateways of South America and Europe, and secondly, the presence of so many air carriers operating to and from Miami airport, provide the necessary dense flight frequencies and a competitive rate structure to attract sea-air cargo flow. In addition, the current airport facilities are adequate to handle greater volumes of cargo.

During June 1992, the aviation department began the first phase of a US $ 500 million cargo facilities development programme, which will continue through the end of the decade. The programme will bring on line 11 state-of-the-art buildings, featuring increased aircraft ramp areas on the airside and redesigned roadways on the landside. These new features will permit the swift transfer of cargo from aircraft to warehouse, to waiting trucks, which play an instrumental role in the multimodal movement of cargo. Cargo warehouse space will increase from the existing 1.4 million square feet to nearly 4 million square feet. Cargo aircraft parking positions will double to accommodate 80 wide-bodied aircraft.

The airport's phenomenal air cargo growth is a result of several significant factors : The strength of Miami Airport, its unparalleled air services, and the stabilisation of many Latin American economies, have all combined to enable this airport to continuously experience gains in air cargo movement. It is geared toward route and fare liberalisation, and is at present served by 91 scheduled air carriers and 52 non scheduled airlines.

1. 13 American scheduled all cargo carriers.
2. 18 international scheduled all cargo carriers.
3. 45 international scheduled mixed carriers.
4. 15 American scheduled mixed carriers.
5. 52 charter carriers.

The operations of these airlines make available unrivalled air cargo capacities, especially to South and Central America, and reasonable air cargo capacities to Europe. Appendices G-1 and G-2, show air cargo capacities made available by each airline operating from Miami Airport, as per the gateway they operate to South and Central America, and Europe.

Table 48. Miami Airport air cargo
(in 1000 tons, rounded to the nearest 100)

	1990	1991	1992	1993	1994
Total domestic cargo (within US)	220	184	204	219	240
Total air exports[1] (int'l)	341	376	430	509	590
Total air imports (int'l)	347	343	403	494	502
Total international cargo[2] (trade)	688	719	833	1,003	1,092
Total cargo handled[3]	908	903	1,038	1,222	1,332

Source : *Airports Council International - Airport Traffic Statistic, 29 March 1995 and Airport Traffic ICAO Digest of Statistic No. 403 - 1992, No. 410, ICAO 1994 - 11/94 Q/P1/1600.*

Notes :
1. *Total international exports.*
2. *Total international imports and exports.*
3. *Total cargo handled = loaded and offloaded at Miami Airport.*

The sea-air option to South and Central America is growing rapidly and becoming the transport mode of choice. Direct ocean services from Europe and the Far East are comparatively very slow and unreliable, especially to the large landlocked markets of South America. In addition, port handling services at almost all South American ports are slow, old fashioned and inefficient. Further, excessive red tape, bureaucracy and pilferage add to the pile up of problems at these ports.

For example, so far only very few foreign shipping lines, airlines and freight forwarders have attempted to establish large distribution facilities in Brazil, the South American country with the highest growth rate, representing an attraction to many international transport enterprises. Because of regulations requiring government ownership of at least 50 percent of any foreign operation, and the precious time-consuming bureaucratic procedures and red tape, a foreign firm, having established itself in Brazil or any South American country, has to employ specialists in each country, capable of sorting out the myriad of different regulations. Some countries require commercial invoices while others require non-commercial ones, or certain documentation required in one will not be required in another.

It is also necessary to understand how goods move in a particular country. In some cases, they must go through a bonded warehouse, which is owned by the government. In Brazil, one must become almost a government entity. These complications are the reason why Latin American shipments are likely to stay in the country's port for a week or two before release for delivery, through overland trucking or railway services, to the final consignee.

On the other hand, direct air cargo capacity on regular flights from Europe and the Far East to Central and South America are very limited and very costly. The sea-air mode of transport is becoming largely the primary choice to Latin America and is practised via Miami and Los Angeles.

Given the 'just in time' market value of goods to consignee, the bureaucratic delays in the final stages of delivery give more reason to the consignee to order the consignments from the shippers at origin, either by direct costly air freight, or via the sea-air mode. The sea-air cargo markets of supply are mainly: Japan, Taiwan, Hong Kong, China, South Korea and, to a much lesser extent, Europe. The supply routes are:

1. <u>The route via the Panama Canal</u>

   Shipping lines calling at Miami from the Asia-Pacific region ports, via the Panama Canal, have not increased their frequencies during the period between 1990 and 1994, though almost all cargo bound for South and Central America is ocean-shipped to the Port of Miami on this route, with an average transit time that ranges between 27 to 30 days. The prospects for a future increase in shipping line frequencies is highly doubtful, and many observers tend to accept a reduction rather than an increase in the long run, as many shipping lines are increasingly using the ports of the West Coast of North America, namely Vancouver, Seattle, Tacoma, Oakland and Los Angeles, rather than the Panama Canal.

2. <u>The route via the West Coast of North America</u>

   A very small part of the Asia-Pacific region's sea-air cargo bound for South and Central America is at present routed via the North American West Coast ports, to connect with departing freighter flights to South and Central America, from adjacent-to-port airports. Cargoes in excess of available capacities from these airports are connected with Miami Airport by overland rail and truck feeder services. In both cases, a saving of 7 - 10 days on transit time is made vis a vis the Panama Canal route to the Port of Miami, yielding an average of 20 days total transit time, from origin to destination. In view of this short transit time, an increase of shipping line frequencies and sea-air flow is more likely to develop on this route.

3. The route from European ports to Miami

The very first sea-air service was initiated by the German freight forwarder 'Kuhne and Nagel' from Europe to South America, via the Port of New York. In the early 1980s, and until the present time in 1995, many European shipping lines started direct services from major European ports to Miami, such as the ports of Algeciras, Rotterdam, Antwerp and Hamburg. European freight forwarders and sea-air operators followed suit and started sea-air cargo movements of European products to the Port of Miami for further on-forwarding by air to South and Central America. Again, the average total transit time was further cut to 15 days on this route. Despite the savings in total transit time, the sea-air cargo movement from Europe to South America is likely to remain stable or grow at a very slow rate due largely to the fact that the South American demand for European made products is fading away, and is gradually being replaced by a strong demand for similar Far Eastern products at much lesser costs.

Table 49: Miami Port

Analysis of container traffic

Tonnage: in thousands. Containers: in thousands

Port	1987	1988	1989	1990	1991	1992	1993[1]	1994[2]
Total no. of containers	224	273	338	374	408	449	458	465
Total container tonnage	1,948	2,128	2,674	2,967	3,242	3,896	3,710	3,673
Containerisation degree (% of general cargo)	**88.5%**	**90.1%**	**92.0%**	**91.0%**	**92.0%**	**93.4%**	**92.5%**	**93.1%**
Av. tonnage/container	**8.6**	**7.8**	**7.9**	**7.9**	**7.9**	**8.7**	**8.1**	**7.9**

Source : *ISL Shipping Statistics Yearbook, Institute of Shipping and Logistics (ISL), Bremen, October 1993 and direct contact with the relevant Port Authorities.*

Notes : *Figures 1987 to 1992 were derived from ISL Yearbook 1993.*

1. & 2 : *Figures for 1993 and 1994 were derived from related periodicals and tested against ISL figures, and average percentage changes per year over six years (1987 - 1992) - periodicals such as the ICHCA Annual Review, World of cargo handling, London, March 1995.*

To quantify the sea-air cargo market via Miami Airport is not a simple task. The US Customs at Miami registers only the locally produced air exports of the state of Florida and the United States. All 'in bond' shipments declared at any port of first entry into the US, and flown, trucked, railed or ocean-shipped to Miami Airport 'in bond', for onward forwarding by air, to a destination outside the US, are not registered by the US Customs at Miami, but are registered by the Airport Authorities as general export air cargo handled by the airlines. An average of 50% to 55% of total air exports by Miami Airport is registered by the US Customs each year as domestic air exports.

Therefore, by a simple operation of deducting the US Customs total air exports figures from the total air exports of Miami Airport, the resultant figure represents a volume of cargo that moved 'in bond' through Miami Airport. The question is, what portion of this in-bond traffic is sea-air cargo?

Miami international air trade:

Analysis of Miami international air trade by region shows that it is confined to two main regions of Latin America (South and Central America) and Europe. There is a complete absence of direct airline international scheduled services with other regions of the world. The major Asia-Pacific gateway airports' sole connection is made available through American Airlines who operate a daily passenger flight service to Tokyo, with an intermediate stopover point at Seattle Airport, and an aircraft change from Boeing 763 to MD11, thus rendering no contribution to the air cargo trade.

The same applies to the regions of Africa and the Middle East, as the very rare flights to these regions are subject to a stopover enroute, and a change of aircraft.

Table 50. Miami Airport international air cargo trade
and percentage share distribution
in (000) tons, rounded to the nearest 100

	1990	1991	1992	1993	1994
Total international freight[1]	688	719	833	1,003	1,092
South/Central American	498	544	614	689	789
% of total	72.3%	75.6%	73.7%	68.7%	72.2%
Europe & rest of the world	190	175	219	314	303
% share of the total	27.7%	24.4%	26.3%	31.3%	27.8%

Source : Computed and Tabulated from International Air Services, DCAD figures released March 1995.

1. *Total int. trade is total trade less domestic trade (Table 48, page 100)*

1. South and Central America

Miami Airport is fully orientated to service the South American market. Though daily direct freighter services are available to the main gateway cities of Europe, freighter services to points in Latin America are by far much greater than those to Europe. There are approximately 100 passenger flights and 40 - 50 freighter flights per day, in each direction, from Miami to various destinations in South America. Miami Airport offers more non-stop cargo services to Latin America and the Caribbean than New York, Houston, New Orleans, Atlanta, Tampa and Orlando airports combined.

Air freight trade with South America is effectively two directional but definitely not balanced. Tables 51 and 52, that follow, show volumes and values of air exports/air imports, and their growth from 1989 to 1994. 1989 is taken as a base year to show percentage change per year over the preceding year for the period under review.

Table 51: Air freight trade with South America (to the nearest 100 tonnes) Exports: Domestic Florida made exports

Year	Export weight	Import weight	Total weight
	(with percentage increase/decrease)		
1989	98,400 (base year)	180,900	279,300
1990	107,300 (+9%)	191,400 (+6%)	298,800 (+7%)
1991	126,700 (+18%)	202,500 (+6%)	329,200 (+10%)
1992	156,700 (+24%)	218,100 (+8%)	374,800 (+14%)
1993	157,900 (+1%)	241,400 (+11%)	399,313 (+6%)
1994	169,300 (+7%)	264,700 (+10%)	434,000 (+9%)

Source: US Customs, Miami - March 1995.

As per US Customs, Miami air imports were almost double the Florida or US air exports in 1989, as shown in the above Table. The imbalance of freight trade movements, i.e. exports being much lower than imports, in terms of weight tonnes, is compensated in terms of dollar values of each. The imbalance of trade is simply reversed in favour of Miami, as seen in Table 52.

Table 52: Air freight trade with South America (value figures x US$ 1 million)

Year	Export value	Import value	Total value
	(with percentage increase/decrease)		
1989	$ 2,755	$ 1,036	$ 3,791
1990	$ 3,124 (+13%)	$ 1,116 (+8%)	$ 4,240 (+12%)
1991	$ 3,541 (+13%)	$ 1,228 (+10%)	$ 4,769 (+12%)
1992	$ 4,330 (+22%)	$ 1,412 (+15%)	$ 5,742 (+20%)
1993	$ 5,036 (+16%)	$ 1,640 (+16%)	$ 6,678 (+18%)
1994	$ 5,410 (+7%)	$ 1,980 (+21%)	$ 7,390 (+10%)

Source: US Customs, Miami - March 1995.

This means that the higher tonnage imports from South and Central America are worth much less than the lower export tonnage of Miami to South and Central America. Imports into Miami Airport are mostly perishables consisting of fresh produce, flowers and fruits and vegetables, the volume and tonnage of which is big in relation to its value. For example, in 1993, Miami imported 241,400 tonnes worth, US$ 1,640 million, or US$ 6,793.70 per tonne (1000 kgs), or US$ 6.79 per kg of freight trade, while Miami exported, during the same year, 157,900 tonnes worth US$ 5,036 million, or US$ 31,893.6 per tonne (1000 kgs), which means US$ 31.89 per kg of freight trade.

Therefore, Miami air-exports high value (computers and electronics, etc.), low weight goods and air imports low value, high weight goods (perishables) in return. Airlines concerned with the movement of such freight apply a relatively high rate per kilogram of air transport on high value (low weight) air exports, while on the return sector, a relatively lower rate of air transport per kilogram is applied to low value (high weight) goods, producing the required result in terms of airline revenues, and, therefore, the application of different rates on each sector is justifiable.

The purpose of this section is to examine how sea-air cargo helped balance, in terms of cargo tonnage, the weight imbalance between Miami and Latin America. The balancing of value trade deficits and surpluses is outside the scope of this research. However, commodity values are definitely relevant to the sea-air cargo analysis in that, almost all sea-air cargo consists of high value, high volume (low density) and low weight cargo.

The main categories of goods transported by the sea-air mode are:
1. Aircraft engines and parts.
2. Business and office machinery parts, accessories, computers, word processors and integrated circuits.
3. Electric and electronic appliances and parts.
4. Electrical tools and spares.
5. Precision instruments and supplies.
6. Musical, optical, photographic, scientific and laboratory

instruments and spares.
7. Imitation jewellery.
8. Toys, shoes, umbrellas, sports accessories and supplies.
9. Leather products, handbags, souvenirs and household items.
10. Textiles and readymade garments.

The relevance of these classes of commodities is manifested further in the ocean segment of transporting sea-air cargoes. It is mostly low density, high volume cargo and occupies the full space of a TEU with an average of 4 to 4.5 weight tonnes per TEU, whose inner usable space is 27 cubic metres, while the same TEU is able to accommodate 20 - 22 weight tonnes.

High value goods tend to absorb a relatively higher cost of transport, whether by air or by ocean. Air transport of high value goods, such as those air exported from Miami Airport, are economically able to absorb an airline air freight rate in the range of 3% to 5% of the value of the goods at origin. Thus, the average value of Miami air-exported goods is US$ 31.89/kg. 4% of that means approximately US$ 1.25/kg for air freight transport to destination.

For example : An airline DC8 freighter service, such as Tampa Airlines, operating between Bogota - Colombia and Miami Airport;
On the first sector - Bogota/Miami, 40 volumetric[1] tonnes of fruits, vegetables and flowers are flown at US$ 0.60 per kilogram, yielding a revenue of US$ 24,000.
On the return sector - Miami/Bogota, 20 tonnes of high value Florida or US made air exports are flown at US $ 1.25 per kilogram, yielding a revenue of US$ 25,000.
The round trip total revenue is US$ 49,000, a figure which is economically acceptable when considering the average cost of a DC8 freighter flying hour ranges between US$ 3,000 and US$ 3,500 to the airline, depending on the base country's general cost of operations. The round trip between Bogota/Miami, consumes between 9 - 10 flying hours. The important point here is that Tampa Airlines have achieved their target of revenues and flown back from Miami with 20 tonnes of high value Florida made goods, with an unutilised capacity equivalent to another 20 tonnes, on the return leg.

By the same token, ocean transport rates of sea-air cargo, just like any other cargo, are set by the shipping lines in terms of a fixed rate applicable on a certain sector per box of 20' or 40', etc. However, most shipping lines levy an extra premium[2] for carrying sea-air cargo as it is carried on a priority basis. It is loaded last at the port of origin, to be off-loaded first at the port of destination. As sea-air cargo occupies more space with lesser weight and is highly volumetric by nature, then the average weight cost per kilogram is higher than other high density ocean cargo moving in containers.

1. Volumetric : Vegetables, fruits and flowers are low dense cargo, occupying larger space and therefore are charged according to the applicable volume to weight ratio of 6 cubic metres to equal one chargeable weight tonne.
2. Extra premium : Sea-air premium charge by the shipping line is tabulated and detailed in Chapter 7, 'Characteristics of the Sea-Air hub', under shipping lines section.

For example : a 20′ ocean container is able to accommodate up to 22 weight tonnes of high density cargo, with an inner usable volume of 27 cubic metres. Shipping lines quote their rates per box size (20′, 40′, 50′, etc.) subject to the sector of ocean transport and the nature of the goods. For example, APL's rate per TEU for general cargo from Hong Kong to Dubai is US$ 1,400, port to port. In case the cargo weight was 10 tonnes, or 10,000 kgs, then the rate per kilogram is US$ 1,400 ÷ 10,000 kgs = US$ 0.14 per kg.

In the case of sea-air cargo, which is high value and low density (volumetric), and occupies the full usable TEU space of 27 cubic metres, with an average weight of 4,500 kgs, then the rate per kilogram is US$ 1,400 ÷ 4,500 kgs = US$ 0.31 per kg. This demonstrates how sea-air cargo is able to absorb higher costs of transport. It is therefore quite realistic to assume that a good part of container cargo imports into Miami Port moves 'in bond' to Miami Airport for further on carriage by air, to South and Central America.

Table 53: **Miami's air trade**
imports/exports between
Miami and S. & Central America
in (000) tons, rounded to the nearest 100 tonnes)

	1990	1991	1992	1993	1994
Total international trade	488	544	614	689	789
Imports	259	272	318	354	373
Re-exports ex Europe[1]	47	43	54	62	74
Domestic made exports	52	76	89	78	87
Total sea-air	130	153	153	195	255
Total air exports	**229**	**272**	**296**	**335**	**416**

Source: *Air International Services DCAD and US Customs, Miami - March 1995.*
Note: *1. See Table 54, page 108.*

2. Europe and the Rest of the World

Having defined the domestic Florida air exports to South and Central America from Miami Airport, as per the US Customs, Table 53, above, it remains to define:

1. The part of Miami's air imports from Europe and the rest of the world that passes in-bond, and is re-exported by air to South and Central America
2. Air exports to Europe and the rest of the world.

Air imports from Europe and the rest of the world are mainly high value, low weight goods, consisting of readymade garments, imitation jewellery, toys, footwear, souvenirs, video games and high-tech products. With respect to international air services, DCAD estimates total air imports into Miami from Europe and the rest of the world to be 70% of the total air cargo trade movement with Europe and the rest of the world, of which the US Customs clears an average of 65% a year for local consumption, and the balance of 35% moves in-bond to South and Central America. While air exports to Europe and the rest of the world are recorded as reported by Miami Port Authorities, in Table 54 below.

Table 54: Air imports/air exports
between Miami and Europe/rest of the world
and the in-bond re-exports share to South & Central America
in (000) tons, rounded to the nearest 100 tonnes)

	1990	1991	1992	1993	1994
Total air imports	190	175	219	314	303
a. Air imports to Miami (average 70% - DCAD)	133	123	153	220	212
b. Air imports, re-exported in-bond to S. & Cent America (35% - as per US Customs)	47	43	54	62	74
Air exports to Europe[1]	35	32	41	65	63
Air exports to rest of the world	22	20	25	29	28
Total domestic made exports	57	52	66	74	91
Total exports (incl. re-exports)	104	95	120	136	165

Source: Air International Services DCAD and US Customs, Miami - March 1995.
1. Air exports to Europe do not include any sea-air volume.

Miami sea-air cargo volume:

The sea-air volume ex North America's West Coast transfer hubs diverted through overland feeder services and the volumes, ex the port of Miami, trucked to Miami Airport, for onward air carriage to South America, is tabulated below.

Table 55. Miami sea-air cargo volumes

Sea-air cargo from	1990	1991	1992 (in tonnes)	1993	1994
Seattle-Tacoma	7,000	6,500	9,000	10,300	10,900
Los Angeles	1,600	2,300	4,800	5,500	8,900
Miami Port	122,500	145,100	139,200	179,200	236,000
Total	130,100	153,900	153,000	195,000	255,800

The implications of sea-air cargo growth to the Airport Authorities, Port Authorities, airlines, shipping lines, sea-air operators and freight forwarders are found in Tables 56 and 57, that follow:

1. From Miami Airport, as a percentage of total international air cargo exports.
2. To Miami Port, as a percentage of total container import traffic and tonnage

Table 56. From Miami Airport
(in 1000 tons, rounded to the nearest 100)

	1990	1991	1992	1993	1994
Total cargo handled[1]	908	903	1,038	1,222	1,332
Total domestic cargo	220	184	204	219	240
Total international cargo (imports & exports)	688	719	833	1,003	1,092
Total air exports *(including sea-air)*[2]	341	376	430	509	590
Total sea-air volume	130	154	153	195	256
Sea-air % of total	**20.3%**	**41.0%**	**35.6%**	**38.3%**	**43.4%**

Source : Airports Council International - Airport Traffic Statistic, 29 March 1995 and Airport Traffic ICAO Digest of Statistic No. 403 - 1992 and International Air Services, DCAD.

Notes : 1. Total cargo handled = loaded and offloaded between Miami Airport and the rest of the world.
2. ICAO Digest of statistics No. 410, ICAO 1994 - 11/94 Q/P1/1600. Total air exports worldwide.

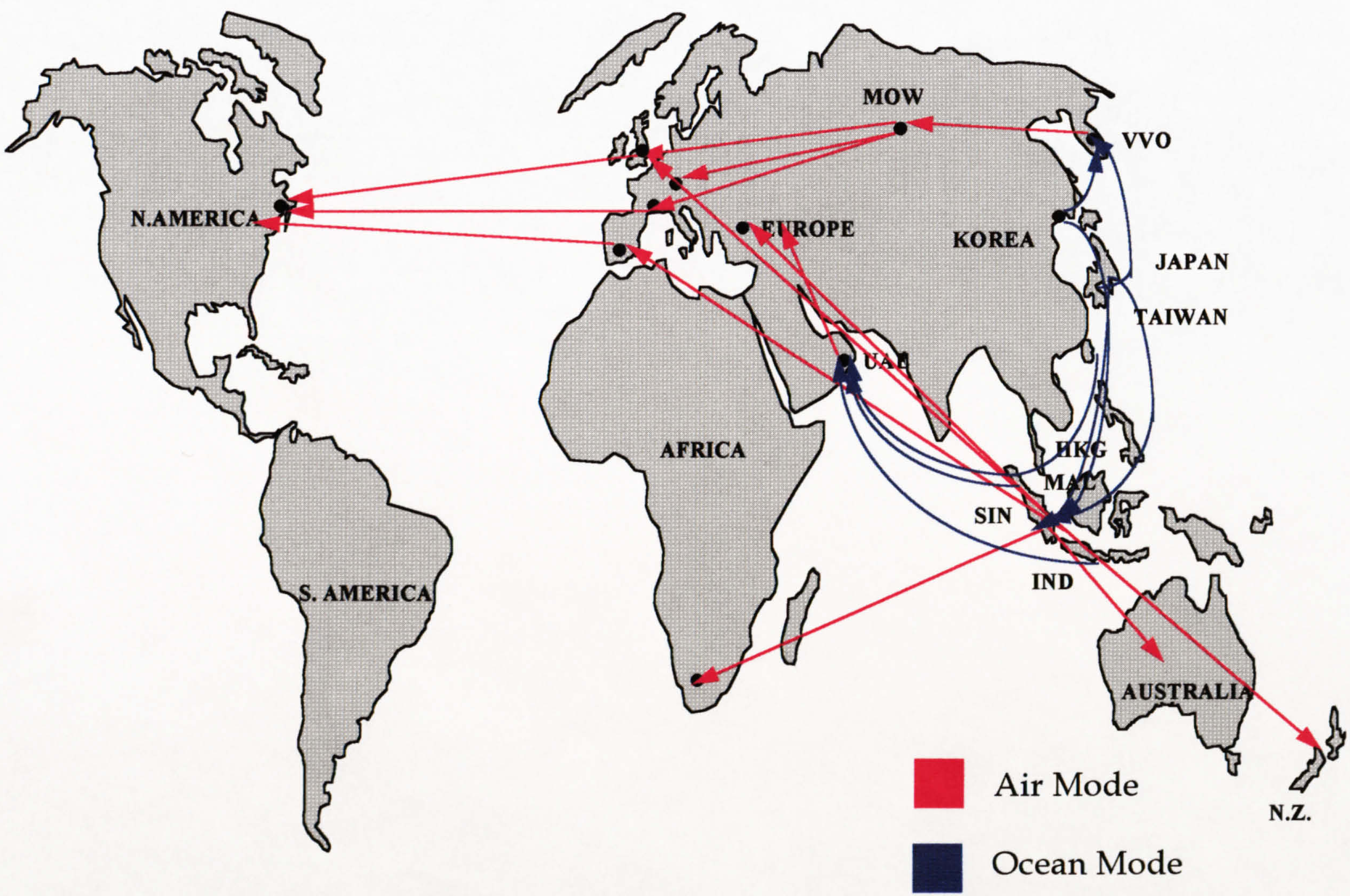
Table 57. To Miami Port
(in 1000 tons & containers, rounded to the nearest 100)

	1990	1991	1992	1993	1994
Total container traffic	374	408	449	458	465
Import container traffic	187	204	225	230	233
Sea-air containers	34	38	41	53	63
Sea-air % of total import	**18.2%**	**18.6%**	**18.2%**	**23.0%**	**27.0%**
Total container tonnage	2,967	3,242	3,896	3,710	3,673
Import container tonnage	1,484	1,621	1,948	1,855	1,837
Sea-air container tonnage	122	145	139	179	236
Sea-air % of total	**8.2%**	**8.9%**	**7.1%**	**9.6%**	**12.8%**

Source : ISL Shipping Statistics Yearbook of 1993 and relevant Port Authorities' direct releases March 1995.

The relevance and importance of sea-air cargo as shown in Table 57, confirms the important role of sea-air cargo in filling the huge unutilised cargo capacities available for air export from Miami to South and Central America, thus balancing the weight imbalance of trade.

Figure 15 : The Sea-Air Eastern Routes



Chapter 6

The Eastern routes - Far East to Europe

6.1 The sea-air route via Vladivostok

Analysis of the sea-air transfer ports of the west coast of America and Canada, showed all the following facts, in varying degrees of influence on the future growth of their traffic to Europe.

High air cargo rates by North American air carriers, and limited air cargo capacities on pro sea-air European carriers, from the airports adjacent to the sea-air transfer ports, forced sea-air operators to divert sea-air cargo flow by overland means of transport (rail/truck), to other airports deep inland or to the east coast airports, where air cargo capacities were available at lower costs, but at a longer transit time of 3 to 5 days.

These facts have forced freight forwarders/sea-air operators to search for alternative transfer ports. In June 1991, the sea-air route via Vladivostok, Russia got a boost when two major operators, Concorde Freight Services and Nippon Express started using this route. In April 1991, Concorde introduced an exclusive freighter service from Vladivostok to Luxembourg and Maastricht, using an Aeroflot IL76, Russian-made aircraft for this flight, with one technical stop at Moscow airport. Sea-air traffic was attracted from only two sources, South Korea and Japan.

Cargo was shipped across the Sea of Japan to the Russian port of Vostochny which is 200 kms away from Vladivostok airport. Cargo was handled, custom cleared and trucked in bond to Vladivostok airport, to ride on the only charter flight arranged by Concorde, and later Nippon, to either Luxembourg or Maastricht, for further distribution overland to various points in Europe.

In theory, the sea-air route via Vladivostok has the advantage of a shorter transit time from origin to destination, when compared with the trans-pacific west coast route. The overall transit time from South Korea to various points in Europe was 7 to 8 days, while from Japan it ranged between 8 to 9 days, a saving of at least 5 days from the trans-pacific sea-air route.

In actual fact, the ocean segment of the journey from South Korean and Japanese ports posed huge problems to over-all transit time. The port of Vostochny was served only by a joint Japanese and Korean service of one shipping line Fesco, (Far Eastern Shipping Line) from Japan. It operated four voyages a month from the ports of Yokohama, Nagoya and Kobe, starting in the south of Japan, and twice a month from Mugata, Toyama and Moji, calling at Vostochny, on its way to the South Korean port of Pusan. This in fact meant a once weekly service from Yokohama, Nagoya and Kobe and a fortnightly service from Mugata, Toyama and Moji.

Concorde executives claimed that they were operating 6 to 8 charter flights per week. This meant that ocean service from Japan and South Korea should bring in, on their once weekly voyage, enough cargo to fill 6 to 8 flights of IL76 aircraft. In other words, the transit time should be lengthened by a further 5 to 6 days from day one of arrival of one week's cargo or 6 flights cargo in one lot to Vladivostok airport.

The IL76 freighter chartered by Concorde and Nippon Express, from Aeroflot, is a fuel hungry aircraft. It consumes between 9.5 to 11 tonnes of fuel per flying hour depending on weather conditions, cruising speed and actual load on board. With one halt en route at Moscow airport for refuelling, the aircraft had to uplift 100 tonnes of fuel on the first sector of the journey at the cost of loading less cargo than its payload capacity. An average of 30 tonnes of freight was loaded on each flight with 175 cubic metres volume capacity. The empty leg back to Moscow, from Luxembourg or Maastricht was sometimes filled by Aeroflot with cargo needed in Moscow. Most of the time the empty leg to Moscow and Vladivostok produced no revenue, and the only reason that the flight was kept operating was the cheap, subsidised, Russian aviation fuel available only to Aeroflot and other Russian airlines.

Despite all the optimism expressed by many major sea-air operators at the onset of this route (such as the statement by the Panalpina group that the transfer via Vladivostok is becoming more and more attractive in terms of both transit time and lower rates, and that this route would continue to assume a market share of the North American route to Europe), the volume of traffic that was attracted to this route was only confirmed directly by Nippon Express, during the researcher's visit to Japan in January 1993. They carried 500 tonnes of sea-air cargo from April 1992 to August 1992, i.e spread over 5 months, or 100 tonnes per month, and thereafter the service was suspended.

Concorde followed suit and suspended their service on this route. Interviews with Concorde officials did not produce any figures, neither did Aeroflot and the Russian authorities at Moscow airport. The researcher resorted to estimation, as follows:

Aeroflot records show 64 flights from June 1991 to August 1992, the time sea-air operations were suspended. Assuming that all 64 IL76 flights carried 30 tonnes each, the total uplift by Concorde was 1,920 tonnes. The question arises; what percentage share was this volume uplift from the total sea-air market of both South Korea and Japan in 1991 - 1992 ?

Official statistics on sea-air volumes are available in Japan from the Ministry of Transport, and are tabulated on the following page:

Table 58: Sea-air tonnages from Japan to Europe
(rounded to the nearest 100 tonnes)

Year	Japan/Europe	South Korea
1988	50,000	39,000
1989	46,600	31,300
1990	55,700	42,600
1991	56,100	45,100
1992	55,300	48,500

Source: *Ministry of Transport - Tokyo*
Note: *South Korean figures are estimate figures by the shipping lines serving Pusan port.*

Nippon carried 500 tonnes over 5 months of operations i.e 100 tonnes per month, while Concorde carried 1,920 tonnes over 15 months of operations, i.e. an average of 128 tonnes per month. Both attracted a total of 228 tonnes per month against an average volume 8,500 tonnes per month from both Japan and South Korea, i.e. volume attracted was 2.7%, a negligible figure. However, the potential of Vladivostok must be considered in view of the shortcomings that were mainly responsible for its suspension in August 1992:

1. Fuel prices doubled in Russia during the second half of 1992. Operating a fuel hungry aircraft such as the IL76 became prohibitively expensive.
2. Lack of interest by Vladivostok local authorities to develop efficient handling facilities for the transiting of sea-air cargo.
3. Infrastructure was, and still is, inadequate for the development and growth of sea-air cargo movements.
4. Airport and Port Authorities were geared and oriented only to their local needs and those of the authorities.
5. Complete absence of freight forwarders.
6. The airport is served by very few regular but highly unreliable flights to points in Russia.
7. The port of Vostochny is served by one shipping line from Japan and South Korea, with very few frequencies.

The potential of short transit time of 7 to 9 days from origin in South Korea and Japan to various points in Europe, together with a possibility of rates equal or lower than those offered via the west coast, remain doubtful for future developments, due to periodic and continuous increases in aviation fuel, and the Russian government's target to match international fuel price levels in 1996 - 1997.

6.2 The sea-air route via Singapore

Singapore, an island nation, with an area of 239.5 square miles (less than that of New York City) and inhabited by 3.5 million active, industrious and diligent people of largely Chinese origin, is a global city that stands at the centre of major trading routes. Singapore is located at the peninsula of Malaysia at the mouth of the Strait of Malacca, the inter-ocean waterway providing the shortest connection between the Indian Ocean and the South China Sea of the Pacific Ocean. It is conveniently located close to Taiwan, Korea, Hong Kong and Australia. Almost all the region's major exporters to the U.S.A. and Europe use Singapore ports and airports for their export transhipments. As such, Singapore is considered a major international transport (ocean/air) transfer hub, and a major gateway to the Asia-Pacific.

Realising Singapore's potential as a commercial centre for import and export trade, Sir Thomas Stamford Raffles of the British East India Company, leased the island from the Sultan of nearby Gingga in 1819, and founded a British settlement under direct British rule. By 1867, Singapore was operating a free trade policy, and unrestricted immigration, until 1930, when it started its own self government. Due to rapid population growth and increased competition from neighbouring countries, it realised that the commercial section alone would not be able to support the island's economic growth. It became necessary, therefore, to action an aggressive marketing plan to encourage industry and foreign investment to the island. With its central location, excellent service infrastructure and the availability of skilled manpower, it encouraged numerous industries such as petroleum refining, ship building, textiles and electronics, to locate in Singapore.

Singapore's central location seems to have developed a behaviourial pattern of general acceptance of medium solutions to all trade issues. The result is a stable economic environment, and one where enterprise is able to flourish. Singapore has flourished from its humble beginnings, in the late 1960s and early 1970s, to become one of the leading commercial centres in the world in just 24 years. It is located in the fastest growing economic zone in the world, in the midst of its Asian counterparts of Taiwan, Hong Kong, Japan and South Korea.

Singapore's general success is attributed to many factors, The most significant are :

1. Singapore Port's position and the facilities available make Singapore the busiest seaport in the world.

2. Singapore Airport's passenger and cargo handling facilities make it one of the most efficient airports in the world.

3. Infrastructure development and telecommunication facilities.

1. Singapore sea port

Between 1993 and 1995, some 195 ship-to-shore container cranes are expected to be delivered, of which 105 cranes (54%) will have an outreach of more than 40 metres and 68 cranes (30%) will have an outreach of 45 metres[1]. The biggest cranes in use today with an outreach of 48 metres are built by Samsung of Japan and Noell of Germany; these two types of high productivity long reach cranes are used by only a few world ports: Singapore Port Authority uses 4 Samsung and 6 Noell cranes in the Brani container terminal.

Table 59, below, highlights and emphasises the position of Singapore Port as the busiest in the world. The 'Institute of Shipping Logistics' - Bremen ranked it as world Number 1 in 1993.

Table 59: Singapore Port

Analysis of container traffic

Tonnage: in thousands. Containers: in thousands

Port	1987	1988	1989	1990	1991	1992	1993[1]	1994[2]
<u>Singapore</u>								
Total no. of containers	2,634	3,375	4,364	5,223	6,354	7,560	8,864	10,200
Total container tonnage	38,400	51,300	65,200	76,600	90,900	109,000	128,600	141,100
Containerisation degree (% of general cargo)	**74.1%**	**76.6%**	**78.1%**	**81.2%**	**83.8%**	**86.7%**	**87.1%**	**90.0%**
Av. tonnage/container	14.6	15.2	14.9	14.7	14.3	14.4	14.5	13.8

Source : ISL Shipping Statistics Yearbook, Institute of Shipping and Logistics (ISL), Bremen, October 1993 and direct contact with the relevant Port Authorities.

<u>Notes</u> : Figures 1987 to 1992 were derived from ISL Yearbook 1993.

1. & 2 : Figures for 1993 and 1994 were derived from related periodicals and tested against ISL figures, and average percentage changes per year over six years (1987 - 1992) - periodicals such as the ICHCA Annual Review, 'World of Cargo Handling', London, March 1995, and from statistical figures released by the Port Authorities.

In the longer term, the key to cost-effective, high productivity, ship-to-shore container handling may be automation. As yet, the complexity of automating ship-to-shore crane operations has presented insurmountable barriers, but technology is moving ahead all the time and a breakthrough could be made in the next few years. The most likely pioneer in this context is the P.S.A. (Port of Singapore Authority), which is currently building a new high-tech container terminal at Pasir Panjang. Pasir Panjang Port is controlled by the Port of Singapore. Aware that the expected growth forecasted would far exceed the Port's handling facilities, the P.S.A. claims that Pasir Pajang will have the handling capacity to cope with 36 million TEUs annually. This, it is envisaged, will feature a Remote Crane Operations System which will control and operate all cranes on the terminal, including ship-to-shore units, from a single control room.

1. Woodbridghe, Clive, 'The World of Cargo Handling', London, March 1995, pages 24 - 27.

2. Singapore Airport

Singapore Airport is served by 64 international airlines with 2,700 scheduled flights every week to and from 119 cities in 53 countries (as at May 1994). They come through Singapore Changi Airport. Passenger handling capacity is more than 30 million a year, the highest in the Asia-Pacific, while cargo throughput was 838,420 tonnes in 1993 and 1,026,703 in 1994[1]. Cargo, in Singapore's Free Trade Zone requires no customs declaration and goods stored are not subject to any duties.

From the moment the aircraft arrives to the moment a shipment is broken down and re-consolidated, it never has to leave the purpose-built Changi Air-freight Centre. All the essential facilities are well integrated within the Centre to provide maximum convenience and clockwork precision in the movement of cargo shipments. Within the 51-hectare air freight centre are three buildings for cargo agents with 45,000 square metres of office space. Over 150 cargo agents are operating at the airport and have their own offices and handling space in these buildings. The centre also houses 5 cargo terminals, 6 parking bays for freighter aircraft, Customs and trade permit offices, an airmail transit centre and a plant and animal quarantine unit.

The Changi Airfreight Centre is a Free Trade Zone. That means freight forwarders and cargo agents can breakbulk and consolidate their shipments with no customs formalities. Sea-air transhipment cargo can be hauled from the port to the airport, trucked across to the freight forwarder's warehouse, sorted, segregated, labelled, re-consolidated and air-palletised, then trucked again across to the aircraft, for loading and eventual flight take off to destination. The whole transhipment process is executed within a few hours.

Red tape, in Singapore Airport handling procedures, is reduced to the minimum. Freight forwarders and cargo agents can make their declarations and apply for their import and export permits electronically through the new TradeNet system - a computer system which links the business communities in the sea and air cargo industries to all controlling bodies.
Customs or trade permits can be obtained even before the plane lands. The information pertaining to the shipments can be transmitted to Singapore Airport and entered into the computer system while the plane is still in the air. Upon arrival, goods can be cleared through Customs and whisked away immediately. This allows much savings on time and labour resulting in a tremendous increase in efficiency. Singapore Customs operates around the clock, throughout the year.

Sea-air cargo via Singapore Airport
The total air trade movement between Singapore Airport and the rest of the world, over a five year period (1990 - 1994) is shown in Table 60, on the following page.

1. Figures in this paragraph were collected from Civil Aviation Authority, Singapore and Airports Council International - March 1995.

Table 60: **Air freight movements**
through Changi Airport
(to the nearest 100 tonnes)

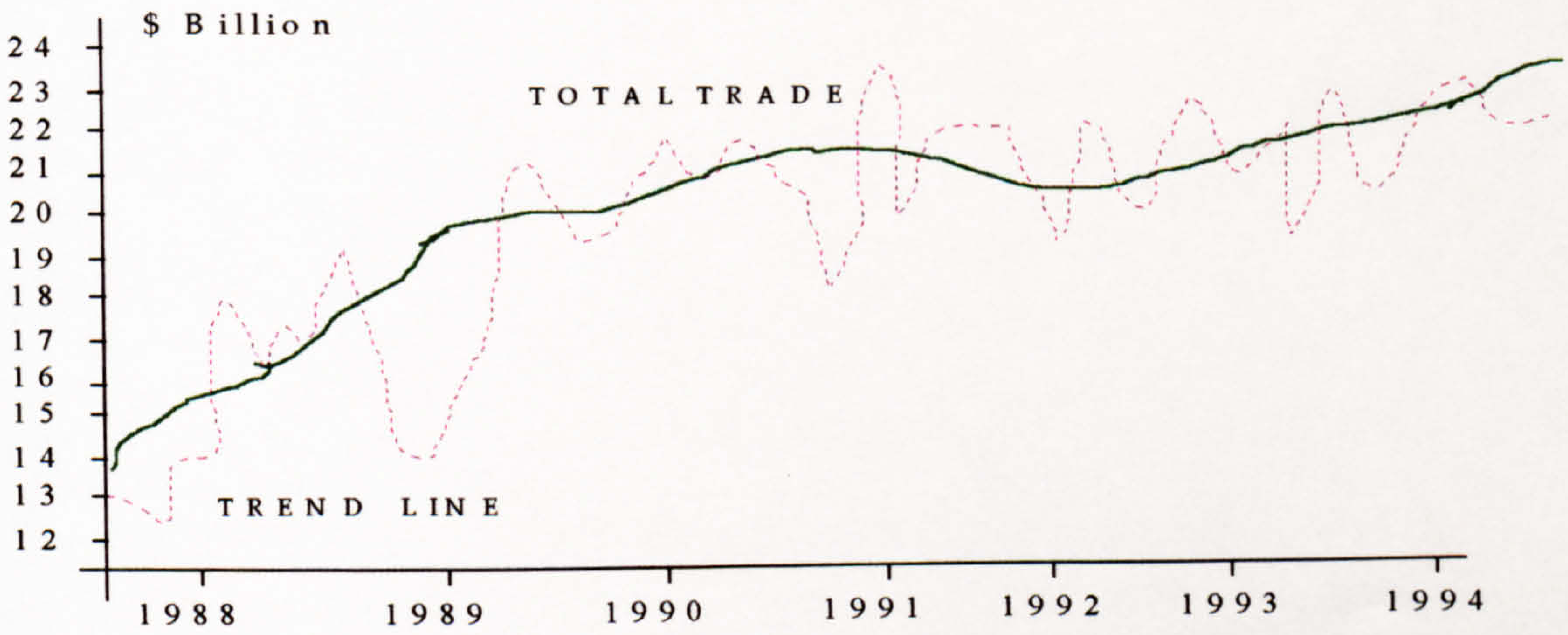
Year	Export weight	Import weight	Total weight
	(with percentage increase/decrease)		
1990	298,700 (base year)	322,300 (base year)	621,000
1991	301,300 (+0.9%)	340,700 (+5.7%)	642,000(+3.4%)
1992	325,700 (+8.0%)	394,300 (+15.7%)	720,000(+12.1%)
1993	368,200 (+13.0%)	470,200 (+19.2%)	838,400(+16.4%)
1994	458,600 (+24.6%)	564,100 (+20%)	1,026,700(+22.5%)

Source: *Singapore Trade Development Board.*

Singapore specialises in high-tech, high value air exports, consisting mainly of computer related products, integrated circuits, disk drives, printers, micro computers, computer parts and peripherals, CTVs and CTV picture tubes, VCRs and parts, as well as organo-inorganic compounds. Air imports are largely composed of semi-finished products which undergo final processing stages at Singapore's high-tech production plants such as integrated circuits, disk drives, blank computer tapes and diskettes, VCRs, CTV and radio parts, electronic components, chemical products and preparation, as well as cigarettes and a few motorised vehicles.

A relatively large part of Singapore imports is re-exported after passing the final stages of production. Singapore's total external trade (imports and exports) figures as released by the Singapore Trade Development Board, at 1985 prices, show the trend and ratio, as depicted in the figures that follow. Imports were over US$12.5 billion in 1994, while exports were US$11.5 billion. The export trade consists of domestic made exports and re-exports of a part of the imported production as explained earlier.

Figure 16 :



Singapore's total external trade, valued at 13.5 billion Singapore dollars, in 1988, was almost doubled in 1994 at 24 billion Singapore dollars. However, it should be noted that total exports were always lower in value than total imports, as can be seen in the chart below :

Figure 17 :

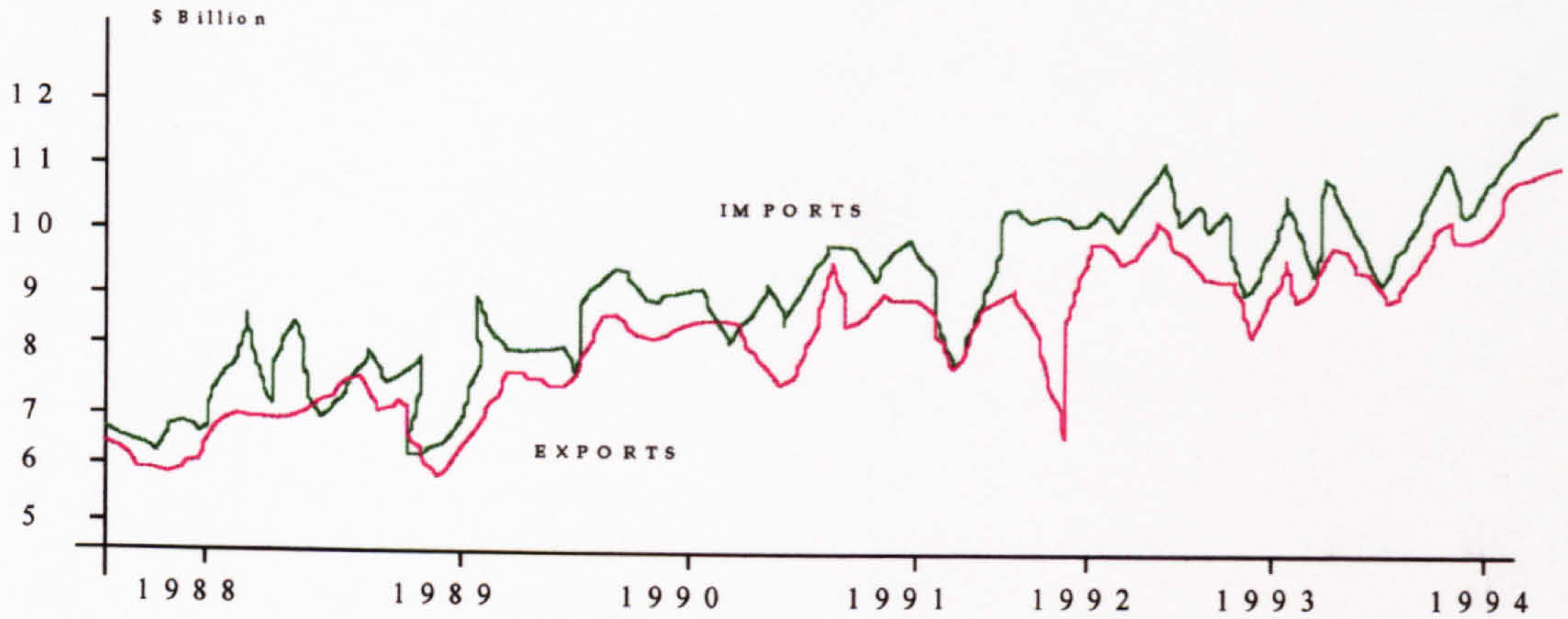
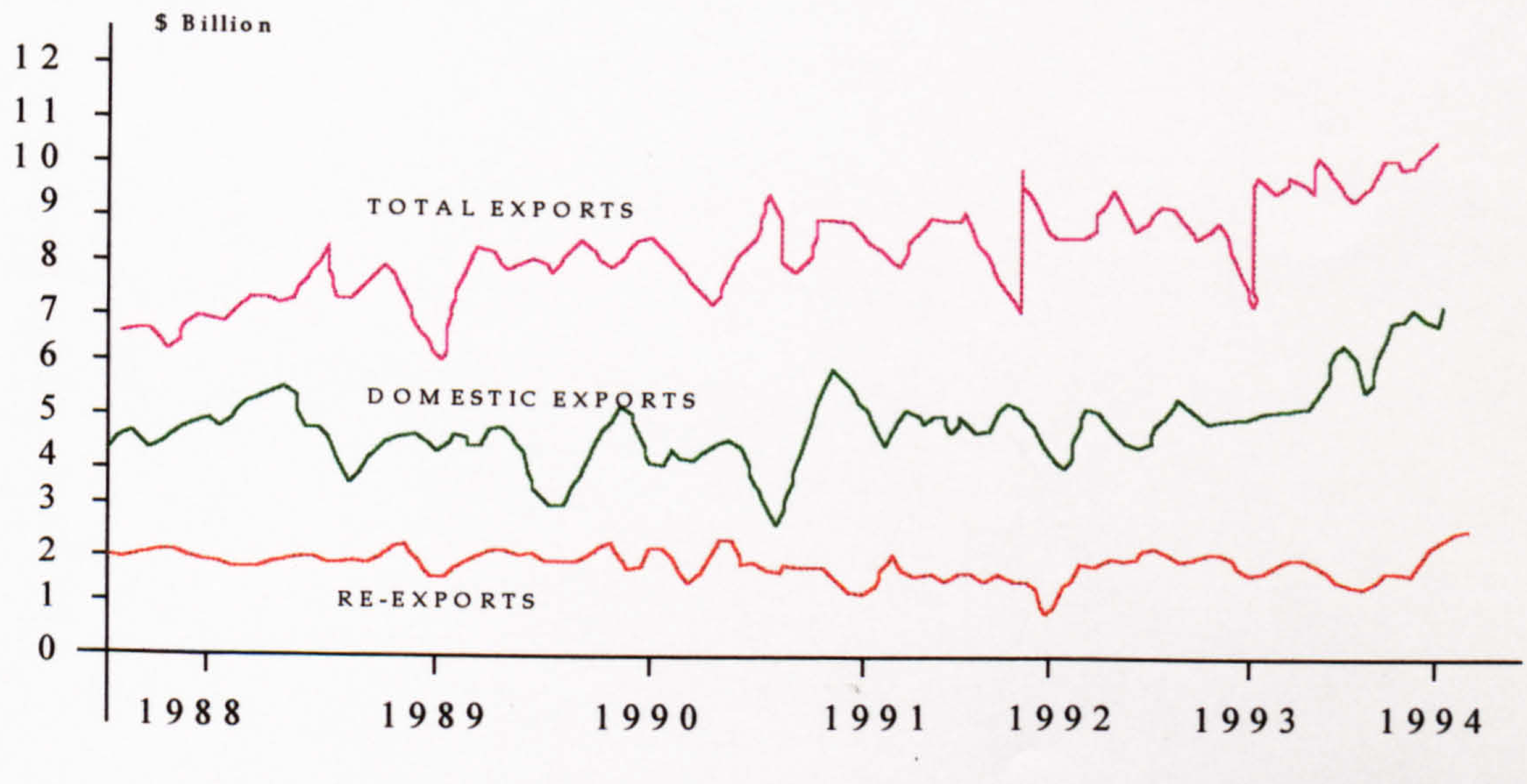


Figure 18 below, shows total exports, domestic and re-export values at 1985 prices.

Figure 18 :



Source : Singapore Trade Development Board - March 1985.

In 1994, total exports reached approximately 11.5 billion Singapore dollars, of which approximately 2.3 billion were oil exports and 6.2 billion were domestic made exports and 3 billion were re-exports. The ratio of re-exports in relation to total non-oil exports averaged 48% over a seven year period, 1988-1994.

Applying the same ratio of 48.0% on total air exports tonnage figures, as released by the Singapore Trade and Development Board, Table 61, below was derived, computed and tested against the Board's estimations and forecasts of re-exports tonnage figures. Sea-air cargo tonnage was quoted in the table as per figures released by the Civil Aviation Authority of Singapore.

Table 61: Sea-Air cargo/total and re-exports between Singapore/rest of the world
sea-air as a percentage of air exports
in tons, rounded to the nearest 100 tonnes

	1990	1991	1992	1993	1994
Total air exports	298,700	301,300	325,700	368,200	458,600
Domestic made exports	155,300	156,700	169,400	191,500	238,500
Re-exports (incl. sea-air)	143,400	144,600	156,300	176,700	220,100
Sea-air share of total air exports	10,800	7,100	4,000	12,100	9,700
Sea-air as a % of domestic exports	7.0%	4.5%	2.4%	6.3%	2.1%

Source: Derived, computed and tabulated by the researcher from figures provided by the Singapore Trade and Development Board.

Domestic made exports and sea-air :

The major markets for Singapore domestic made exports, in rank and degree of their percentage share of total are: U.S.A., Europe, Malaysia, Japan and Australia.

Table 62: Singapore's domestic made exports
dollar value and percentage share of the importing region
(in millions of Singapore dollars - 1994)

Country	Dollar value	Percentage share of the total
U.S.A.	2,100	33.8%
Europe	1,700	27.4%
Malaysia	500	8.1%
Japan	400	6.5%
Australia	200	3.2%
Others	1,300	21.0%
Total	6,200	100.0%

Source : Singapore Trade Development Board - March 1985.

Air exports of Singapore, in terms of weight tonnage, occupy a much higher percentage than the percentages of their dollar value, due mainly to the fact that :

1. Exports to adjoining Malaysia are made via a railroad causeway across the Jahore Straits which connects Singapore with the Malaysian mainland in a few hours.
2. Exports to Japan, Taiwan, Korea, Thailand and Hong Kong are made largely via the intensive ocean feeder frequencies at low cost and of very short transit time of 5 - 7 days.

All high value products that are able to absorb air freight costs are not in fact air freighted, but ocean shipped or railed, as in the case of Malaysia. Therefore, most of the available air cargo capacities from Singapore Airport, is utilised for:

air exports to U.S.A	48.0%
air exports to Europe	32.0%
air exports to Australia/N.Z.	8.0%
air exports to the rest of the world	12.0%
	100.0%

Source - Civil Aviation Authority of Singapore - March 1995.

Sea-air cargo volume was only 5,000 tonnes in 1987 and grew to 6,700 tonnes in 1988, and 7,500 tonnes in 1989 (Table 64, page 123). The big increase was in 1990 due to the Arab Gulf Crisis when nearly 25% of the sea-air cargo bound for U.A.E. Ports was diverted to Singapore and the balance to North American West Coast sea-air transfer hubs. It then resumed its pre-Gulf Crisis level in 1991 an 1992, as shown in Table 61, on page 119.

Sea-air cargo movement via Singapore did not develop a continuous upward trend until the beginning of 1993, when volumes started to break the 10,000 tonnes level, to reach 19,700 tonnes in 1994, and an expected 25,000 tonnes in 1995. Sea-air cargo movements via Singapore did not develop as a selected sea-air mode per se, that is for its specific lower than direct air transport cost and shorter than all ocean transit time. It developed as a necessity and as a forced alternative to the air cargo capacities and flight frequency problems that became chronic in the neighbouring highly industrialised countries, mainly South Korea and Japan, who, like all other Pacific Rim countries' air exports to the markets of North America occupy over 50%[1] of all their available air cargo capacities, despite the high frequencies. Direct air cargo from Taiwan, Thailand, South Korea and Japan to the U.S. had to wait 5 - 7 days at the airports of origin, during the high season, for their turn to be uplifted.

The same situation was true for the underdeveloped countries of the Asia-Pacific. Such was the case of Sri-Lanka, Bangladesh and the southern parts of India, where the vast majority of the garment industries were geared to orders from the U.S. These orders were subject to quotas and specific delivery dates, with each country having a different quota status set by the U.S. government. Those quota orders were subjected to delivery in the

1. Source - Civil Aviation Authority of Singapore and 'Singapore Air Cargo, a publication of the CAAS.

U.S. to fall within a specified period of time. Substantial garment exporting countries such as India declare a 'free sky policy' from time to time, allowing international airlines to freely clear the backlog of mountains of garment volumes piling up at their main gateway airports for air exports to the U.S.

Shippers in all these countries, whether highly developed or under-developed, resorted to whatever means available to air-export their orders 'in time'. The phenomenon of air-to-air transport emerged. This means that where cargo capacities were scarce or unavailable, shipments were air freighted to an intermediary point from where air cargo capacities were available to the required destination. For example from Dacca Airport, in Bangladesh, a shipper would air freight his cargo to Singapore or Bangkok or Dubai, where cargo capacity is available, and request his forwarder to arrange re-forwarding from this intermediary airport to final destination in the U.S., 'in time', even at much higher combined air freight costs, than the current applicable air freight cost from the airport of origin, direct to the destination airport.

As the regional sector flights' capacities become fully utilised, i.e. DACCA/Bangkok, DACCA/Singapore or DACCA/Dubai, and in cases of the Pacific Rim when regional sectors flights' capacities become fully utilised between the main gateway airports of South Korea - Japan and that of Singapore, then and only then was the sea-air mode used via an intermediary point where air cargo capacities were available, be it Singapore or Dubai.

As the use of the sea-air mode gained reliability and continuity, it was found by shippers, freight forwarders and sea-air operators in South Korea and Japan, that some savings could be made, without adversely affecting the total transit time that would have resulted if direct air was used.

For example: direct air freight costs from Tokyo and Seoul to London, average US$ 5.00 per kilogramme, while the same direct air freight cost from Singapore to London, averages US$ 3.50 per kilogramme. Therefore, connecting the Tokyo and Seoul cargo, by ocean, with Singapore Airport, results in marginal savings equivalent to an ocean cost average of 0.35 per kilogramme plus Singapore direct air freight costs of US$ 3.50 = US$ 3.85, less direct air freight costs from Seoul or Tokyo of US$ 5.00 per kilogramme, i.e. a saving of US$ 1.15 per kilogramme.

<u>Transit time</u> :

Almost all shipping lines' scheduled journeys from Taiwan, South Korea, Hong Kong and Japan, to Australian and New Zealand ports have their first port of call at Singapore Port. Nearly the same schedule of ocean journeys apply from those origin ports, to Europe's main ports of Rotterdam, Antwerp, Felixstowe and others.

Most shipping lines, calling at the Port of Singapore, schedule 5 to 6 regular voyages per week, in addition to dense and regular ocean feeder frequencies operated by smaller sized ships and shipping lines, from the industrial centres of the Far East, mentioned earlier. The duration of the ocean voyages from closing time[1] at the ports of origin to the port of Singapore ranges from 5-7 days. However transiting Singapore Port to the airport can be done in a few hours at any time during the day or night. Ship arrivals, in terms of weekdays, became immaterial due to the dense daily ocean frequencies. However, arrival times were considered in terms of weekends and certain hours of the day which varied with ocean weather conditions such as storms during the monsoon season etc. 12 - 24 hours is accepted by all concerned in the sea-air industry, as the time required to transport sea-air cargo from the port to the airport. Transit time averaged 1 to 2 days from actual discharge time of cargo at the port, to the time of relevant flight take-off to destination.

Table 63: Sea-air cargo transit time in days
via Singapore

Port of Origin	Europe	Australia/N.Z.	South Africa
Japan	9	10	12
South Korea	8	9	11
Hong Kong	7	8	10
Taiwan	8	9	10

Source : Civil Aviation Authority of Singapore

Though air capacities increased drastically in 1994, air cargo space still is not easily available at Singapore Airport. KLM operates two pure freighter flights, in addition to five combi[2] B747s, to Amsterdam. Lufthansa operates four weekly combis to Frankfurt, and Air France operates three weekly combis to Paris. Lately, Air China started operating one pure freighter B 747 to Luxembourg, in March 1994,. Appendices H-1 and H-2 show air cargo capacities made available from Singapore Airport. Air China was not included due to their late start of operation, and the unreliability of their frequencies.

The bulk of sea-air cargo is carried by Singapore Airlines on its regular scheduled 6 freighter services per week to Europe, and numerous wide-bodied passenger flights.

1. closing time : is the time required by shipping lines and freight forwarders for final preparation of shipments to ready for carriage, such as: labelling, marking, final staking into containers with final custom seal and loading of containers onboard ship and final preparation of documents, invoices, B/L, voyage manifest and bay plan/cargo plan.

2. Combi - a mixed passenger and cargo flight, where cargo is loaded on the main deck along with passengers, with a partition separating both. The B747 combi has an average available air cargo capacity of 30 tonnes.

It should be noted that the Singapore average of 385 daily international flights fell short of providing reliable direct air connections to various major cities in Africa. Less than 20 African destinations are served with 1 to 3 flights per week, almost all flights with transfer connections at intermediate points to other airlines, a fact that makes Singapore a very poor transit point for sea-air cargo destined to Africa in general. The only country in Africa served from Singapore, with some degree of efficiency, is South Africa[1].

In conclusion, the sea-air cargo flow, via Singapore, is very small in relation to the major sea-air transfer hubs of the U.A.E., Seattle, Los Angeles and Miami.

<u>Sea air cargo via Singapore</u> : implications and future trends

Table 64: Development of sea-air tonnages via Singapore
(all figures in tonnes)

Year	1986	1987	1988	1989	1990	1991	1992	1993	1994
Total	3,732	4,976	6,721	7,566	10,817	7,165	3,926	12,100	19,700
Av annual Growth	base year	33.3%	35.1%	12.5%	43.0%	-33.8%	-45.2%	208.0%	62.8%

Source : Civil Aviation Authority of Singapore

The growth of sea-air cargo volumes, starting from 1986 onward, showed a steady yearly increase until the end of 1990, the year of the Gulf War Crisis, where an increase of 43% over the previous year was recorded due to the diversion of some of the U.A.E. bound traffic to Singapore. However, the figure of sea-air tonnage recorded in 1991 was not only a return to pre-Gulf War levels, but also a return to almost the same level of 1989, with no appreciable growth over 1989 sea-air volumes.

Sea air tonnage	
<u>1989</u>	<u>1991</u>
7,566	7,165

In 1992, a much lower volume was recorded, of approximately 4,000 tonnes. This simply means that sea-air cargo developments did not follow a specific trend of growth or decline during the period between 1986 and 1994. There were sporadic ups and downs as seen in Table 64, above.

These fluctuations are explained as follows :
The drastic drop of sea-air cargo volume in 1991 an 1992 was

1. South Africa : Johannesburg, South Africa, is served by three jumbo mixed flights per week from Singapore. All three flights are via Mauritius and Bombay, and involve a transfer to other airlines, a fact that increases transit time by 1 to 2 days.

mainly due to the introduction of (a) two weekly B747 cargo flights by Air China from Taipei to Luxembourg in 1991, in co-operation with the Cargolux trucking system which took care of carrying cargo further to final destinations in Europe overland. (b) two weekly B747 cargo flights by Air Hong Kong from Hong Kong to Manchester and Brussels in 1992, and later increased to 4 B747 cargo flights per week. Both airlines launched their flights at slightly lower air freight rates, thus attracting most of the sea-air cargo that was routed via the Singapore route to the air-to-air mode. This meant that volumes of cargo that were bound for Singapore by ocean, for onward carriage by air, were diverted to the regional air sector connecting Japan and South Korea with an intermediate point where air cargo capacities were available to the required final destination.

The basic implications are :

1. The diversion to Singapore Airport means that sea-air cargo via Singapore is largely dependent on the availability of air cargo space from origin (before diversion) to destination, and that the savings derived from the use of the sea-air mode via Singapore does not represent an important factor to shippers and consignees. On the other hans, the shortest possible transit time of direct air, or direct air via an intermediary airport, was most important in selecting the mode of transport to be used.

2. The Asia Pacific region is a very strong generator of origin/destination air cargo, and each of its country's available air cargo capacities are almost fully utilised all year round. Any air capacities that become available in any country of the Pacific region, in excess of its own domestic air exports, are immediately utilised by the adjacent country, through the air-to-air transhipment mode. Thus, the available air cargo capacities, specially those of the national carriers, serve the domestic air exports on a priority basis; any excess air capacity is then offered to serve air-to-air transhipments from surrounding countries, and is offered lastly to sea-air shipments.

3. Sea-air cargo via Singapore Airport is air-carried to its destination at the same cost as all other air cargoes. In the fast developing countries of the Asia Pacific regions, the growth of origin/destination cargo is so fast, that demand on air cargo capacities from their airports becomes much greater than supply. Many freight forwarders interviewed in Jakarta - Indonesia and Bangkok - Thailand, during February 1995, confirmed that a premium, ranging between 7 - 10%, over and above the airline published rate, is levied by the airline on confirmation of space to air freight shipments, especially those bound for U.S. destinations on a certain day with a confirmed date of delivery.

Field research and interviews with relevant entities confirm statements made earlier in this chapter, that sea-air cargo thrives on the availability of unutilised capacities and its role as 'fill in' cargo marginally supporting airline revenues on the sector used and is welcomed by the airline industry in general. Such a basic characteristic of sea-air cargo does not hold true in the case of Singapore Airport or any Pacific Rim airport, for that matter.

Therefore, the researcher is of the view that sea-air cargo, via Singapore Airport, is to be looked upon as 'almost direct air cargo', because, as discussed and analysed in this section, sea-air cargo via Singapore in particular, was not diverted from ocean transport, but was originally air cargo, 'searching' for air cargo space for eventual uplift to its destination.

In conclusion, the future of sea-air cargo via Singapore is dictated by largely one factor, namely the availability of unutilised cargo capacities. As more and more capacities are made available by the airlines, in excess of demand generated by the domestic air exports, it will present an opportunity for sea-air cargo to develop and grow.

6.3 The sea-air route via the United Arab Emirates

The U.A.E. was formed in 1971, replacing the old association of the Trucial States with Britain. Located at the southerly end of the Arabian Gulf, the U.A.E. comprises 7 Emirates, where oil discoveries have brought about colossal development in the last 25 years, resulting in the modern, prosperous country it is today.

There are many factors which have made the U.A.E. the leading transportation hub in the Middle East region today. Most important is its strategic location, midway between the manufacturers of the Far East and consumers of the West, its well developed infrastructure, extensive distribution network, a low cost vibrant economy and an aggressive 'Free Trade' atmosphere.

The sheer number of entry and exit points in the U.A.E. - six modern international airports, and seven major sea ports, provide a variety of choice to the operators, and also generate a healthy competition among themselves, thus leading to lower port handling charges. These gateway ports and airports are close to each other, and connected by a fast motorway network that makes distance between any port and the other, or between any port and airport, within 2 - 3 hours trucking time.

Cargo entry to any of the U.A.E. ports is free of government restrictions. Feeder vessels are able to offload cargo at any of the gateway ports and truck them inbond to the re-export gateway hub of their choice. Thus, the possibilities of time loss due to congestion is ruled out with an additional bonus of very low trucking rates available between the various ports of the U.A.E.

All major U.A.E. ports are equipped with the latest container and bulk cargo handling equipment. Large container terminals are located around the ports. Fast and 'free of restrictions' motorways and a round the clock trucking system is available. All the above services are offered at relatively lower costs than other similar hubs of the region. As a result, a large number of shipping lines are calling on the ports of the U.A.E. with regular frequencies. The U.A.E. ports have become a major re-distribution centre, mainly to the Arabian Gulf states, the Middle East and Europe. The Far East centres of production are increasingly using U.A.E. ports for its low cost facilities and short transit time. The re-distribution of cargo from the U.A.E. ports includes sea-air cargo volumes that originate mainly from Taiwan, Hong Kong, Singapore, Bangkok and the Indian subcontinent.

The arrival schedule of the shipping lines and total sailing time are of vital importance to the entire sea-air product, as is speed and efficiency in making the containers, carrying sea-air cargo, available for transit from port to airport.

The sea ports of the United Arab Emirates :

1. <u>Mina Zayed</u>

Located in the Emirate of Abu Dhabi, Mina Zayed has increased its traffic flow over its docks by some 21% in 1993 to a total of 1.4 million tonnes in container and general cargo. Vessels calling at the port in 1993 increased to 1,520. During the first 6 months of 1994, 698,137 tons of cargo and 42,800 TEUs were handled at Mina Zayed.

2. <u>Fujairah</u>

On the East Coast of the U.A.E, Fujairah is a 'Free Zone' Port offering shipping lines and related businesses the benefit of comparatively very low storage fees on their imports and exports, and no duties, as long as goods remain within the Free Zone Area. Fujairah handled 649,373 TEUs in 1993, with a total of 730 ships calling at the port. This represents a 23% increase on 1992's figures. The first 6 months of 1994 showed an increase of 21% to 347,514 TEUs, which is in line with the increase in 1993.

<u>Sharjah Ports Authority - Port Khalid and Khorfakkan</u>

Sharjah is the 3rd largest of the Emirates, and is the only one which can boast to offer the facility of ports, on both the Arabian Gulf and the Indian Ocean. The two ports are linked by a fast motorway known as the 'Sharjah Mini Bridge'.

3. Port Khalid

Port Khalid is located on the West Coast of the Emirate of Sharjah and was the first port within the U.A.E. to operate a 'Free Zone' which was established in 1978. It is also world famous for pioneering the Middle East's first container terminal and also is renowned for developing the region's first in-port alongside cold store, which is able to hold 9,000 tons of cargo. Other facilities at Port Khalid include a container terminal covering 150,000 square metres and offering storage for 8,000 TEUs, 9,300 square metres of transit sheds and storage areas.

The 3 berth terminal offers handling equipment such as two 35 tonne Lieber T115 gantry cranes, having an outreach of 35.06 m and a span of 30.49 m. and 2.30 ton capacity SWL (sway less) transtainers which are supported by other vehicles with 12 metre flat beds or chassis trailers. Other handling equipment, which are available upon request, include mobile cranes with a 40 ton capacity, and handling devices for side, top or end lifting.

4. Port Khorfakkan

Located on the East Coast, Khorfakkan has been built on a natural harbour site and was constructed to complement Port Khalid, following the demand for a second port in the Emirate of Sharjah. Khorfakkan flourished during the Gulf War crisis, when many shipping lines used the port in preference to entering the waters of the Gulf. Due to the excellent facilities and service offered, many of these shipping lines still utilise Khorfakkan as their preferred port. They, therefore, do not need to commit their vessels through the sensitive Straits of Hormuz, and have benefited from gaining faster voyage times, and much less insurance premiums. Thus the Port of Khorfakkan handled in excess of 1,000 vessels in 1993, of which approximately 50% are feeder services.

The port handled a total of 446,475 TEUs in 1993, an increase of 24% on 1992. As 80% of the TEUs handled in 1993 were trans-shipment cargoes, Khorfakkan has established itself as a major trans-shipment point.

In 1986, Gulftainer, on behalf of Sharjah Ports Authority, was given the contract to market Khorfakkan which has, in turn, led to an upsurge in traffic through the port. In line with this increase, Khorfakkan commissioned two further 40 tonne capacity ship-to-shore container cranes at the end of 1990, increasing the total to four. Two additional gantry cranes were commissioned in 1993, bringing the total to six.

5. Port of Mina Sagr

Located at Ras Al Khaimah on the East Coast, Mina Saqr is seeking to increase its output and is now developing a reputation for efficiency and the handling of a wide range of feeder services. In 1993, Mina Saqr handled approximately 4.5 million tons of cargo. In the first quarter of 1994, general bulk cargo increased by 41%, with the largest increase being trans-shipments which rose to 356,733 tonnes. With Mina Saqr's location offering vast time savings, and its excellent feeder services, traffic is steadily increasing due to many shipping lines considering the port's benefits.

6. & 7. Dubai Ports Authority (D.P.A) - Jebel Ali Port and Mina Rashid

Located in the Emirate of Dubai, Jebel Ali Port and Mina Rashid are controlled by the D.P.A. Since its formation in 1991, the twin ports now rank 15th in the world in terms of the container handling business. In 1993, the D.P.A. witnessed a 12% increase in port activity with total tonnage increasing to 24.15 million, containers handled rising to 1.7 million and the amount of ships calling increasing by 10% to 9,694. Today, the two ports service over 100 shipping lines, with container tonnage representing 61% of D.P.A's throughput in 1993 and 63.5% in 1994.

The latest figures released by D.P.A. show a strong growth between January and July of 1994, with freight totalling nearly 26 million tons (of which 19.5 million tons was carried in just over 1 million TEUs). D.P.A. predicts that figures for TEUs in 1994, could well exceed 2 million.

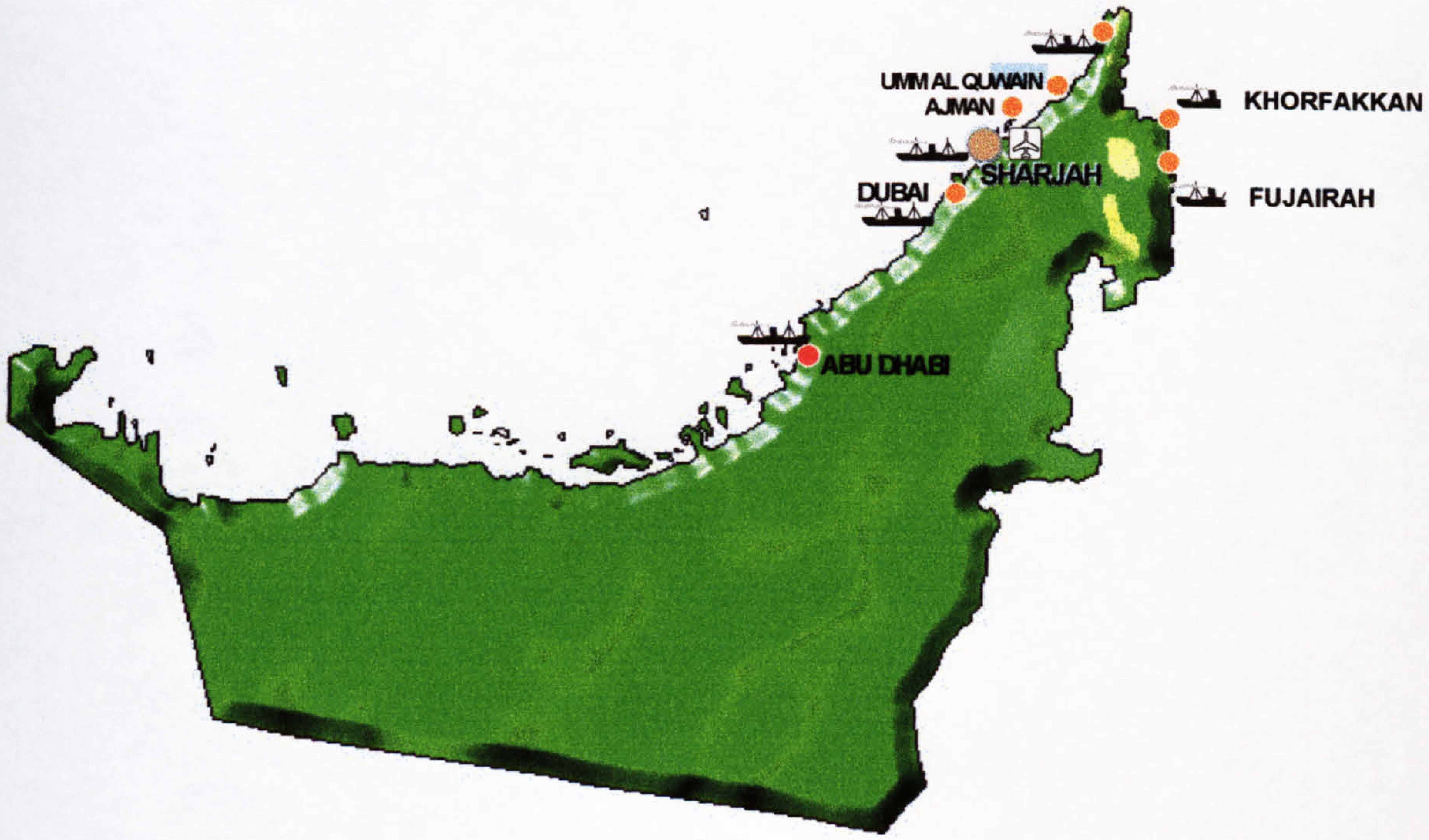
Facilities at Mina Rashid and Jebel Ali Port are of the highest standards, offering 102 deep water berths, dedicated transit sheds and purpose-built facilities for freight forwarders, sea-air operators and shipping lines, handling and sales agents. Equipment available includes PANAMAX cranes and other specialised container handling equipment of the highest standards.

Table 65: Dubai Ports (Rashid & Jebel Ali)
Analysis of container traffic
Tonnage: in thousands. Containers: in thousands

Port	1987	1988	1989	1990	1991	1992	1993[1]	1994[2]
Dubai Port Rashid & Jebel Ali								
Total no. of containers	596	657	869	966	1,265	1,390	1,693	2,055
Total container tonnage	7,145	7,378	9,349	13,340	15,180	16,400	24,150	28,360
Containerisation degree (% of general cargo)	**56.2%**	**55.5%**	**58.4%**	**59.0%**	**62.1%**	**60.1%**	**61.0%**	**63.5%**
Av. tonnage/container	12.0	11.2	10.8	13.8	12.0	11.8	14.3	13.8

Source : ISL Shipping Statistics Yearbook, Institute of Shipping and Logistics (ISL), Bremen, October 1993 and direct contact with the relevant Port Authorities.
Notes : Figures 1987 to 1992 were derived from ISL Yearbook 1993.
1. & 2 : Figures for 1993 and 1994 were derived from related periodicals and tested against ISL figures, and average percentage changes per year over six years (1987 - 1992) - periodicals such as the ICHCA Annual Review, 'World of Cargo Handling', London, March 1995, and from statistical figures released by the Dubai Port Authorities.

Figure 19 :



U.A.E. - The sea-air cargo hub

The U.A.E., located midway between the Far East and Europe, provides excellent grounds for sea-air growth. Since crude oil was its main export, many aircraft were leaving the U.A.E. with vast volumes of unutilised air cargo capacities. Pioneers of the sea-air business were aware that if they could find cargo to fill in these capacities, airlines would offer attractive rates on the return leg to Europe. It was necessary, therefore, to convince the Far East shippers to utilise U.A.E. ports as a hub for European bound cargo.

30 freight forwarders, specialising in sea-air, have located offices in the U.A.E., handling between them approximately 35,000 tons of sea-air cargo and offering a total transit time of approximately 15 to 16 days from the Far East to Europe.

Dubai International Airport

In 1991, Dubai International Airport opened the cargo village, where major cargo airlines such as British Airways, Emirates Airlines, Air France, Singapore Airlines, Cathay Pacific, Cargolux, China Airlines, KLM, Alitalia, Air Hong Kong, Air India, Olympic, Kuwait Airways, Egypt Air, Royal Jordanian, Turkish Airlines, Middle East Airlines, Gulf Air and many others have all opened offices. The cargo village has 300,000 square metres of space with the capacity to deal with 250,000 tons of cargo annually. Dubai Cargo Village handled a record 218,264 tons in 1993, an increase of 14.73% over the previous year and 243,100 tonnes in 1994 (Table 66, page 131).

As a direct result of the 'Open Sky Policy', adopted by all of the U.A.E,. airports, some 240 flights depart daily from Dubai Airport, which are operated by scheduled and unscheduled carriers. Thus, any gaps in sea-air business left by the scheduled carriers are increasingly being filled by the unscheduled and charter services.

Dubai Cargo Village :

DCV (Dubai Cargo Village) currently consists of a central cargo building - housing the Administration offices, DNATA (Dubai Airport government Handling Agent of all airlines operating from Dubai Airport), airlines, Customs, Government offices and police and security staff - and a freight forwarders building. The main complex comprises 7,800 square metres of office space, an 8,300 square metre handling area and space to store up to 5,000 tonnes of cargo. Its airside apron can accommodate up to four Boeing 747s or a combination of two B747s and three narrow-bodied freighters simultaneously.

DCV's proximity to Port Rashid and Jebel Ali - just a 15 and 45 minute drive away, respectively - has also helped establish Dubai as one of the world's leading sea-air cargo hubs, ahead of Seattle and Singapore. Dubai Cargo Village is to undergo expansion to its cargo capacity, which has reached its limits. Extension and modifications to the existing 25,000 sq metre central cargo building will raise DCVs warehouse capacity by a third to 350,000 tonnes a year. A new 10,000 sq metre custom-designed courier and mail complex as well as a second cargo freight forwarders building is under construction and scheduled to start operating by the end of 1996, early 1997.

Dubai International Airport's facilities for handling consignments, brought in from Dubai's two sea ports and the Port of Khorfakkan and Fujairah, 160 kms away, and its ability to take delivery of shipments at seven fully equipped sea-air truck docks, means that freight carried on bonded vehicles can be loaded into a departing flight, within as short a period of time as six hours (see footnote on page 138), depending on the exact time of flight take-off. With over 60 international airlines, attracted by the government's 'open sky policy', operating to over 100 destinations from Dubai, the choice of carriers available to the U.A.E.'s cargo community is vast.

Table 66, on the following page, shows total cargo handled, air imports and air exports, including sea-air volumes tabulated over a period of five years.

Table 66. **Dubai International Airport's**
Air imports vs Air Exports
(in tonnes)

	1990	1991	1992	1993	1994
Total air cargo handled	144,300	140,300	186,400	217,700	243,100
Air imports	91,200	89,200	113,000	130,100	136,900
Total air exports (including sea-air)	53,100[1]	51,100[2]	73,400	87,600	106,200
Sea-air tonnage	14,600[3]	11,500[4]	12,500	9,200	6,000
Sea-air % share of total exports	**27.5%**	**22.5%**	**17.0%**	**10.5%**	**5.6%**

Source : *Department of Civil Aviation, Dubai, & DNATA releases of March 1995.*
Notes:
1 & 2. : 3 & 4 *Air exports and sea-air tonnage dropped drastically during 1990 and 1991 because of the Arab Gulf Crisis. 1990 figures represent 10 months of normal activity before the Gulf waters were declared a 'war zone' and 1991 figures represent 9 months of normal activity after the easing of 'war zone' restrictions.*

As seen in Table 66, above, total air imports were always in excess of total air exports inclusive of sea-air volume via Dubai Airport. Theoretically, this means that aircraft arriving into Dubai Airport are discharging volumes of cargo much greater than the volume uplifted (air exports) on their return leg. This is based on the assumption that all flights arriving into Dubai Airport are terminators, and must return to their point of origin. This also means that unutilised capacities become available due to this directional imbalance.

Table 67. **Unutilised air cargo capacities**
due to directional imbalance - Dubai Airport's
(in tonnes)

	1990	1991	1992	1993	1994
Unutilised capacity due to directional imbalance of imports vs exports	38,100	38,100	39,600	42,500	30,700

Source : *Dubai Airport Authority and DNATA releases of March 1995 and computed and tabulated by the researcher - see Table 128.*

This unutilised air cargo capacity was computed by simply deducting total air exports, including sea-air cargo, from total air imports. But total air import figures do not necessarily mean that aircraft and airlines bringing in this air import cargo have already utilised all their available air cargo capacity on their first leg. Assuming a flight load factor of 70% on the first leg, the balance of 30% must be added to the unutilised capacity already in existence, on the return leg, due to the directional imbalance of trade.

Table 68. Total unutilised air cargo capacities
due to directional imbalance - Dubai Airport's
(in tonnes)

	1990	1991	1992	1993	1994
Unutilised capacity due to directional imbalance of imports vs exports	38,100	38,100	39,600	42,500	30,700
30% first leg assumed unutilised & must be added to the second leg	38,800	38,200	48,400	55,800	58,700
Total unutilised air cargo capacity on the return leg	**76,900**	**76,300**	**88,000**	**97,300**	**89,400**

Source : *Table 67, and computation based on the assumption of a 70% freight load factor on the incoming first leg.*

This available unutilised air cargo capacity is valid in theory only. In order to give this analysis a meaningful conclusion, a short study of the actual flight routing of those airlines who are the providers of air cargo capacity for sea-air cargo, between Dubai Airport and European airports, was made in order to determine more accurately the available air cargo capacities on their return leg flights to Europe.

Dubai Airport :unutilised air cargo capacities and sea-air cargo:

The analysis that follows will try to determine the air cargo capacities made available from Dubai Airport, for sea-air cargo use, the percentage utilisation and trends of growth or decline.

In 1994, air cargo capacities made available from Dubai Airport to Europe by scheduled international terminator flights, averaged 36,100 tonnes per annum, while capacities by transiting scheduled international flights averaged 34,700 tonnes per annum, for a total of 80,800 tonnes per annum (see Appendices I-1, I-2 and I-3). This air cargo capacity is not only made available for cargo destined to Europe, but also for cargo destined to the U.S. and Canada, via an intermediate stopover point in Europe, which may entail a change of aircraft and flight number.

It should be noted that airline transit flights' cargo capacities available on the return leg from Dubai to Europe, make available another air cargo capacity on their initial first leg from Europe via Dubai, to the sub-continent of India and the Far East, equivalent at least to the volume of cargo discharged at Dubai Airport, as imports. These capacities are partially filled with cargo originating in Dubai. As per Dubai Airport Authority statistics - Department of Civil Aviation, 136,900 tonnes were discharged as air imports. This same capacity becomes available for total air exports from Dubai Airport. Therefore, as 80,800 tonnes are available for air exports to Europe, then at least the balance of 56,100 tonnes (136,900 less 80,800) of capacity (see Tables 67 and 68 on unutilised capacities on page 132) becomes available on eastward routes to the sub-continent of India, and the Far East.

As per the source quoted above, the total air export volume from Dubai was 106,200 tonnes in 1994. The concern of this study is to determine, what part of this volume of air exports was destined to Europe and North America. Therefore, its share of available air cargo capacities on this sector, will determine the balance share remaining for sea-air cargo.

Statistical support on domestic air exports and the portion of air imports re-exported from government departments, the Chamber of Commerce and Airport Authorities was not available. The researcher had to conduct interviews with ten major airlines and eight major, Dubai based freight forwarders, in March 1995.
The findings are; the U.A.E. accommodates over one and a half million expatriates from all over the world. The largest is the Indian community, with close to 700,000 people working in the U.A.E., followed by Pakistanis, Filipinos, Sri Lankans, Egyptians, Middle East nationalities and Europeans.
These people find the U.A.E. a tax haven. Until August 1994, all imports, with the exception of liquor and cigarettes, were subject to a 1% import duty. In August 1994, this duty was raised to 4%. Expatriates look at the U.A.E. as a shopping paradise. They shop for lots of electronic goods, home appliances, carpets, souvenirs, wearing apparel and, in general, goods that are available in the U.A.E. at low prices, but which are very expensive in their home countries. Most of these goods are ocean-shipped to their home countries, but also an appreciable portion is exported by air.

Estimates by the freight forwarders interviewed showed that air exports on the eastern route, i.e. from Dubai to the sub-continent of India and the Far East, and the neighbouring Arab countries, averaged the following in 1994:

1. Air exports to the Indian sub-continent and the Philippines each averaged 15,000 tonnes and to Egypt 6,000 tonnes p.a.

2. Transit cargo - air to air transhipment, the part of air imports, re-exported in transit to its relevant destinations on connecting flights, averaged 5,000 tonnes p.a.

3. All others, including the surge of air exports to CIS countries, which started in 1992 and took momentum in 1993 and 1994, in addition to air exports to destinations in the Arab Gulf States and the Middle East countries, averaged approximately 5,000 tonnes per year.

The total of 46,000 tonnes, when related to 106,200 tonnes, as the grand total of air exports, gives a ratio of 43.3% to the Eastern route. Therefore, applying the balance of this ratio, air exports to Europe and North America (the western route) are approximately 106,200 x 56.7% = 60,200 tonnes, of which 29,200 tonnes transit air-to-air as re-exports.

The major domestic air exports of the U.A.E., comprise one major commodity besides sea-air cargo, and this is the 'readymade garments' product. The garment industry started in the late 1980s and took full swing in 1993 and 1994, when it reached the 25,000 tonnes level, with most of it bound to the U.S. and Canada. Before the introduction of the garment industry in 1989, most of the air cargo capacities available were utilised by the sea-air cargo flow; at present, the available capacities for sea-air from Dubai Airport are around 26,600 tonnes (Table 69, below), of which only 6,000 tonnes was utilised in 1994, resulting in fierce competition by the airlines operating from Dubai Airport, bringing down the airfreight costs to Europe by an average of 15%.

Table 69. **Airline Air cargo capacities**
by type of utilisation - 1994
Dubai/Europe-N. America

Type	Air cargo capacity(tonnes p.a)
Total available air cargo capacities	80,800
Total domestic air exports	54,200
Of which garments tonnage	25,000
Transhipment re-exports in transit	29,200
Available capacities	**26,600**
Sea-air cargo tonnage	6,000
Sea-air % utilisation of balance available capacity	**22.5%**

Source : Computed, derived and tabulated by the researcher from data in earlier parts of this section.

Sharjah International Airport :

Sharjah International Airport rises from the desert like an oasis, its traditional Islamic design makes it a strong contender for the world's most beautiful airport. However, underneath that striking exterior lies an airport with state-of-the-art facilities which have resulted in a steady growth in traffic. Situated just 10 kilometres from the City of Sharjah, 15 kms from Dubai's Port Rashid and 45 kms from Jebel Ali Port, the airport is linked by a four-lane highway with Port Khalid and Port Khorfakkan, as well as the rest of the U.A.E. ports. Sharjah has over 60 years of experience in aviation which began back in 1932 when British Imperial Airways built an airfield there as a stop-over point for its India and Australia services.

Today, the airport which is managed with the support of Frankfurt Airport Authority, is able to handle 2.5 million passengers per year. Cargo handling facilities include two warehouses with 15,000 square metres of floor space, a cargo apron which can accommodate up to six narrow-bodied aircraft or four 747s (all pure freighters), 24-hour customs, a free-zone facility and efficient documentation procedures.

Equipped to deal with any type of cargo, the airport has special facilities for handling and storing valuables, mail and dangerous goods. The size of this facility was doubled in 1992 to meet growing demand. A custom-built ramp and shaded pens provide for the prompt transfer of livestock, a business in which Sharjah specialises, handling everything from camels and horses, to goats and sheep. Livestock and refrigerated goods represent the airport's main imports, with sea-air forming the bulk of the export traffic. Additional growth areas include Eastern Europe and Africa where the lifting of import restrictions there has attracted many CIS and African air carriers.

Airlines are given the opportunity to provide their own cargo warehouse handling. A major airline, Lufthansa, took immediate advantage and started its cargo hub at Sharjah Airport in May 1993, and by the third quarter of 1995, was operating approximately 45 weekly flights to and from Sharjah Airport. The bonded warehouse offers customers security for their shipments and can be used as a distribution centre for the Arab Gulf States. Sharjah operates an 'open sky policy' where any carrier can start an operation, with no restrictions on any 'Freedom of the air'. Permission is usually granted to all commercial flights within 24 hours. Sharjah Airport is considered, as per the latest release of ACI (Airports Council International - April 1995) as one of the region's fastest growing airports, in terms of cargo handled (Table 70, below).

Table 70. **Sharjah International Airport's**
Air imports vs Air Exports
(in tonnes)

	1990	1991	1992	1993	1994
Total air cargo handled	28,800	28,100	25,000	77,000	103,600
Air imports	9,700	8,800	7,800	18,300	19,200
Total air exports (including sea-air)	19,100[1]	19,300[2]	17,200	58,700	84,400
Sea-air tonnage	11,300[3]	12,200[4]	9,300	10,700	16,100
Sea-air % share of total exports	**59.2%**	**63.2%**	**54.0%**	**18.2%**	**19.1%**

Source : Sharjah Airport Authority - March 1995.

Notes:1 to 4: Air exports and sea-air tonnage dropped drastically during 1990 and 1991 because of the Arab Gulf Crisis. 1990 figures represent 10 months of normal activity before the Gulf War, and 1991 figures represent 9 months of normal activity after the easing of 'war zone' restrictions.

Table 71. Sea-air volume and cargo capacities
percentage utilisation - 1994
Sharjah/Europe-N. America

Type	Air cargo capacity(tonnes p.a)
Total available air export cargo capacities	66,800
Total domestic air exports	39,300
Of which garments tonnage	17,400
Transhipment re-exports in transit	21,900
Available capacities for sea-air	**27,500**
Sea-air cargo tonnage	16,100
Sea-air % utilisation of balance available capacity	**58.5%**

Source : Computed, derived and tabulated by the researcher from data in earlier parts of this section.

Abu Dhabi International Airport :

Abu Dhabi International Airport (new ADIA) has seen significant growth in its first 12 years of operation. From 1982 to 1993, a total of 31 million passengers were handled, representing an increase of 158% on the 12 million passengers handled between 1970 - 1981, by the old airport. Presently Abu Dhabi Airport is serviced by 50 international scheduled carriers, operating an average of 400 flight frequencies per week.

Located 25 kms away from Abu Dhabi City, and 100 km from Dubai's Jebel Ali Port and 160 km from Dubai's Port Rashid, new ADIA has an advanced overland double carriage fast motorway transport network linking it with the rest of the Emirates' cities.

Described as the most modern in the Middle East, its freight apron is able to handle 10 Boeing 747s simultaneously. Re-fuelling is carried out through underground fuelling systems, and the old mobile units supplying electric power to the aircraft have been replaced by ground fixed outlets. The cargo complex covers 24,000 sq metres and is able to handle 85,000 tonnes of cargo annually, and is used by carriers operating 26 B747s and 21 DC10 freighters weekly, to 12 destinations.

Various handling equipment are available, such as 'elevating transport vehicles' (ETVs) with over 70 storage beds fitted with electronic weighing scales. With cargo figures of air exports showing an increase of 21.6% over 1992 and imports an increase of 38.1% for the same period, it was necessary to improve facilities, to cope with the anticipated growth and compete with other neighbouring airports for a larger share of the market.

The Department of Civil Aviation, therefore, enlisted the help of British consultants Halcrow, to upgrade and improve the airport facilities. The 'Master Plan' will enable new ADIA to cater to 10 million passengers per year, by the year 2020. The planned improvements include; re-modelling of the existing terminal to reduce congestion in the short term and to be supplemented by either an extension to the original terminal or the construction of a new one by the year 2000. Six additional aircraft stands and additions to the taxi-way are to be provided. The taxi-way is to be improved, as well as service facilities such as the new extension to the aircraft maintenance facilities.

Table 72. Abu Dhabi International Airport's
Air imports vs Air Exports
(in tonnes)

	1990	1991	1992	1993	1994
Total air cargo handled	34,100	32,700	35,300	50,200	56,500
Air imports	22,300	20,200	22,400	31,400	34,300
Total air exports (including sea-air)	11,800[1]	12,500[2]	12,900	18,800	22,200
Sea-air tonnage	2,300[3]	4,000[4]	500	1,600	3,800
Sea-air % share of total exports	**19.5%**	**32.0%**	**3.8%**	**11.8%**	**17.1%**

Source : *Department of Civil Aviation, Abu Dhabi - March 1995.*
Notes:
1 & 2. : 3 & 4 *Air exports and sea-air tonnage dropped drastically during 1990 and 1991 because of the Arab Gulf Crisis. 1990 figures represent 10 months of normal activity before the Gulf waters were declared a 'war zone' and 1991 figures represent 9 months of normal activity after the easing of 'war zone' restrictions.*

Abu Dhabi Airport's total air exports follow almost the same ratio as Dubai; approximately 45% of the total of 22,200 tonnes rode the eastern route to the sub-continent of India, the Philippines, Sri Lanka, the Arab Gulf States and countries in the Middle East, while 55% were air carried on the western route to Europe and North America, which was approximately 12,200 tonnes.

Table 73. Sea-air volume and cargo capacities
percentage utilisation - 1994
Abu Dhabi/Europe-N. America

Type	Air cargo capacity(tonnes p.a)
Total available air export cargo capacities	26,000
Total domestic air exports	18,400
Of which garments tonnage	16,100
Transhipment re-exports in transit	2,300
Available capacities for sea-air	**7,600**
Sea-air cargo tonnage	3,800
Sea-air % utilisation of balance available capacity	**50.0%**

Source : *Computed, derived and tabulated by the researcher from data in earlier parts of this section.*

Abu Dhabi Airport's potential to develop sea-air cargo volume is impressive, as the possibilities are currently available for almost 80% growth. This could most likely occur if the airlines and the Airport Authorities, both, offer a certain flexibility in the airfreight costs presently applicable from Abu Dhabi Airport. This is required to absorb the costs of overland transport of sea-air cargo from the APL sea-air cargo hub at Fujairah Port, which is over 300 kms away from Abu Dhabi Airport.

The sea-air scene in the U.A.E.

U.A.E. Ports and Airport Authority organisations, in co-operation with U.A.E. based sea-air operators and freight forwarders, have set a record of 6 hours[1] to transit containers from ports to airports, including airline palletisation. This record depended largely on actual ship's arrival time during normal port working hours. According to pre-alerts, all formalities were prepared in advance and offloading from onboard ship to onboard trucks was done in few hours. However, the total average transit time in the U.A.E., ranges from 12 to 24 hours, based on the time schedules of shipping lines and the flight frequency of the airlines.

The scheduled services of steamship lines to Dubai Port and Fujairah Port as their first port of entry to the United Arab Emirates is summarised in Table 74, below.

Table 74: Container vessels serving *Dubai/Fujairah from the Far East*

SHIPPING LINE	PORT	DAY OF ARRIVAL	DAYS FROM KOR	HKG	TWN	SIN	BKK	BOM
APL	FJR	FRI	18	14	12	8	20	-
K-LINE	DXB	SAT/WED	19	14	13	10	17	-
MOSK	DXB	SAT/WED	19	14	13	10	17	-
NYK	DXB	SAT/WED	19	14	13	10	17	-
NOL	DXB	NO SCHEDULE AVAILABLE						
OOCL	DXB	SAT	22	19	17	12	-	04
SEALAND	DXB	FRI	27	18	16	10	-	03
MAERSK	DXB	SUN	20	15	14	10	-	03
UASC	DXB	THU	19	15	13	09	-	03

Source : Shipping lines' schedules 1992 - 1993.

As this table shows, vessels arrive in Dubai or Fujairah during most days of the week, but the majority of sea-air cargo arrives on Friday with APL. The reason for this is that they offer a better transit time than the other shipping lines, from the Far East Ports. As an example of the impact of the ship schedules,

1. Al Naboodah Cargo Centre (a freight forwarder based in Dubai) broke all records with a fastest handling time of 6 hours from ship arrival at Dubai Port to onboard scheduled EK flight 001 for London (Khaleej Times - 15 September 1987).

APL played a leading role in carrying sea-air cargo to the U.A.E., mainly via Fujairah Port.

Their arrival time on Friday gave just enough time to make the transit to the majority of cargo flights which depart Dubai/Sharjah airports on Saturdays (LH, AF, CV, LD, MP, SQ, CX using 747s, KU, RJ, TMA using 707s, SU IL76, EK[1] A310, and AZ[2] and HK using B747 freighters - see Appendices I-1 to I-4, on airline capacities.). For ships arriving on Saturdays, the transit time allows sea-air cargo to make it on the cargo flights which depart Dubai/Sharjah airports on Sundays (LH, AF, CV, SQ, CX, CI using 747s, KU, RJ using 707s, EK A310, and HK using a B747 freighter.). For ships arriving on Sundays, transit time allows sea-air cargo to make the transit for the Monday cargo flights which depart Dubai/Sharjah airports (LH, AF, LD, CX using 747s, TMA using a 707, EK using a A310, and AZ using a MD11). For ships arriving on Wednesdays, transit time allows sea-air cargo to make the flights on Thursday (LH - 2 flights, CX and SQ using 747s, EK using a A310, and AZ - 3 flights using MD11s).

Arrivals from the Indian subcontinent are on Tuesdays and sea-air cargo connects with outgoing Wednesday flights. It must be emphasised that the majority of Indian sub-continent sea-air traffic arrives on Wednesdays and Fridays, and departs on Thursdays and Saturdays respectively. Even though there are a large number of cargo flights available from Dubai and Sharjah, there are also supporting flights from Abu Dhabi Airport on a regular and charter basis. Sharjah offers the largest number of charter cargo flights. It also needs to be emphasised that regular transiting cargo flights originating in the Far East, for European destinations have limited air cargo capacities, as priority is given to originating Far East cargo to Europe.

The air cargo scene of the U.A.E. contributes positively to the development and growth of sea-air cargo. The presence of three major modern international airports, equipped with advanced cargo handling facilities and large cargo terminals, and the competition among these airports, have led to lower cargo handling and turnaround costs. This served as an added incentive to the 'Open Sky policy', adopted by the U.A.E. government as from the early 1970s up to the present time.

In the late 1970s and early 1980s many international airlines started using U.A.E. airports on a regular basis, and often flew back with hardly any cargo load onboard. Air cargo capacities were available but unutilised. With increased frequencies of flights, the air cargo capacities available were also increased. Further increases in air cargo capacities were prompted by the rapid growth of Arab airlines who started operating wide-bodied aircraft, specifically the 747. In 1970 the combined fleet of Arab air carriers was 137 narrow bodied aircraft. By 1986, this figure had grown to 335, of which 120 were wide-bodied aircraft

1. EK A310 daily passenger flights to Europe, with a capacity of 36 cubic metres, or 12,000 kgs per flight.
2. AZ have three passenger flights per week to Rome, using MD11s with a cargo capacity of 22 cubic metres, or 7000 to 8000 kgs per flight.

and by the end of 1994, the fleet grew to 474, of which 190 were wide-bodied. With the growth of sea-air cargo in the early 1980s, and up to the present time, large volumes became available, and available air cargo capacities were only partially utilised (see Appendix A).

A remarkable development took place in the mid 1980s, and started growing rapidly. The 'Free Zone' of Jebel Ali witnessed the birth of many garment factories. This phenomenon spread to the rest of the Emirates. In 1991, 115 garment factories were producing readymade garments in full swing, in response to orders from the U.S.A., Canada and Europe. Exports of readymade garments were subjected to US quotas. The trend in the U.A.E. slowed down and garment factories mushroomed in the nearby Gulf states such as, Qatar, Kuwait and the Sultanate of Oman.

These developments generated huge volumes of export freight which moved either by ocean or by air. The bulk of readymade garments were high fashion items and were required urgently at the consumer markets in mainly the U.S.A. and Canada. The bulk of this volume was air freighted and therefore helped 'fill in' a large part of the unutilised air cargo capacities of most airlines calling on U.A.E. airports.

These developments induced airlines to introduce terminating 747 freighter flights in 1991. Lufthansa became the pioneer of the jumbo freighter terminating flights, availing a weekly cargo capacity of 260 tonnes, followed by Cargolux availing a capacity of 140 tonnes per week to the U.A.E. market. Other jumbo freighter flights transiting the U.A.E. offered, together, an average of 1,250 tonnes capacity per week.

In summary:
Almost all the sea-air cargo routed via the U.A.E. originates from Taiwan, Hong Kong, Singapore, Bangkok, India, Colombo and Pakistan. Indonesia and Malaysia accounts for a marginal volume, but is steadily growing and assuming an increasing portion of the total market. Very little cargo originates out of South Korea because of longer transit time, when compared with the route via the west coast of N. America. The same applies to Japan.

Table 75. Airline Air cargo capacities
and sea-air utilisation - 1994
Dubai/Sharjah/Abu Dhabi Airports

Type	Dubai	Sharjah	Abu Dhabi	Total
Available air cargo capacities for sea-air	26,600	27,500	7,600	61,700
Sea-air cargo volume	6,000	16,100	3,800	25,900
Sea-air % utilisation of available capacity	22.5%	58.5%	21.6%	42.0%

Source : Computed, derived and tabulated by the researcher from data in earlier parts of this section.

In conclusion, U.A.E. ports and airports serving as sea-air hubs have an immense potential to absorb much greater loads of sea-air cargo because :

1. A high frequency of shipping lines call at U.A.E. ports from the production centres of the Far East.

2. Cargo handling facilities and cargo terminals are available at lower costs than at other transfer hubs[1].

3. Congestion and loss of time in transfer, is ruled out due to the presence of many ports, and the proximity of the ports to the airports.

4. Air cargo capacities, from various airports in the U.A.E. to Europe, are available, or can be made available, with short notice, i.e charter freighter services are readily available from Sharjah Airport on an almost daily basis to Amsterdam, Brussels and Maastricht. Also, re-distribution to any point in Europe by European trucking systems is now a reliable procedure from not only Amsterdam, Brussels and Maastricht, but from all major entry gateway airports of Europe.

The total sea-air cargo uplift from the three U.A.E. airports is shown in Table 75, page 140 - a figure much less than the average available air capacities. Room for growth and expansion is already available on regular scheduled flights. It must be stressed that air cargo capacities are further increased by the availability of empty legs of charter flights from this area. An exact figure could not be drawn due to the fact that none of the three U.A.E. airports keep any figures on this particular uplift.

1. Port terminal charges at U.A.E. ports were found to be around US$ 0.03/kg, while those of Seattle and Los Angeles were in the range of US$ 0.05/kg. See footnote on page 151 for detailed analysis.

Part III:
Characteristics and trends of the sea-air chain and the transfer hubs.

Chapter 7

Geography and regulations

There are many characteristics that a sea-air transfer hub should have. However, no single factor can be used to characterise a sea-air hub. The emergence of a successful sea-air hub requires an optimal balance with each of the characteristics, such as, geographical location, government rules and regulations, quality of sea port facilities, nature of airport facilities, ocean carriers, air carriers and the freight forwarders.

It is the objective of this research to analyse each of these characteristics in the context of the sea-air hub, and demonstrate how they must work jointly to build up its attractiveness and reliability.

7.1 Geographic location

The aim of sea-air intermodality is to transport goods from origin to destination in a continuous and controlled flow and in the most time/cost effective manner. The geographic location of a transfer point becomes important in relation to time and cost of transport.

This means capitalising on relative advantages of various modes of transport at each transfer point of the whole journey. The geographic location of a transfer point is a prime factor in relation to speed and time values of cargo movement. The value of speed depends on the value of journey time to the shipper and consignee. If the time of transport by various carriers and the transit periods of load transfers are considered as a deferred satisfaction of consumer's demand, then the speed of transport is directly proportional to the cost of transport. The higher the speed, the higher are the rates (cost of transport).

Speed may be considered as a factor of time and distance. The value of goods, in general, depend on their condition on reaching the consumer's market. This is a function of time, and many goods will require a certain period of transit time to reach a particular market in a condition acceptable to consignees and/or consumers.

The geographic location of a transfer point becomes a function of transit time in relation to value of goods, inclusive of their transport cost on reaching their destination. The factors determining the service of a certain transfer point depend on this relative value of time in relation to the product value at final destination. Given the nature of the product and markets of demand, the value of time becomes the sole consideration in the choice of a transfer point, provided that all available transfer points have equal facilities.

A case study on sea-air cargo movement conducted by Hong Kong based FETA[1], and released to FETA members during their annual meeting held in March 1988 in Singapore, shows clearly the importance of transit time in relation to the sea-air cost of transport. The research finding still holds true in 1994[2]. Shipping lines did not introduce faster ships, nor change their first ports of call en route, since that time. Ocean and air freight costs, and therefore the combined sea-air costs are still applicable with an average currency adjustment factor on the US dollar of +5%, since its exchange rate versus other world currencies has depreciated much in the past six years. The research is updated as follows.

Table 76: Transit time/cost of sea-air transport
(Far East to Europe)
on all sea-air routes

	Western route via Seat/Vanc/LA		Eastern route via U.A.E.		via HK/Sing	
Ports of origin	**Tr.time (days)**	**Cost/kg ($)**	**Tr.time (days)**	**Cost/kg ($)**	**Tr. time (days)**	**Cost ($)**
Japan	14	1.75	20	1.60	7	2.50
Korea	14	1.75	20	1.60	7	2.50
Taiwan	18	1.65	18	1.50	7	2.50
Hong Kong	18	1.65	17	1.55	-	-
Singapore	18	1.65	17	1.55	-	-
Thailand	19	1.60	18	1.55	7	2.50
Malaysia	18	1.65	18	1.55	7	2.50

Source: FETA research released in March 1988 at their Singapore annual convention
Tr. time : Transit time
Cost/kg, ($) : US dollars per kilogram average cost to sea-air operators
Seat/Vanc/LA : Seattle, Vancouver and Los Angeles
HK/Sing : Hong Kong and Singapore

Notes :

1. Sea-air cargo moving from the Far East to Europe was defined as cargo having an ex factory value of more than US$ 5.00/kg.

1. Far East Transport Association, Hong Kong, whose members are major sea-air operators in the Far East (Japan, South Korea, Taiwan, Hong Kong, Malaysia and Singapore), U.A.E. and Europe.
2. Updating 1994 figures was done through direct fax contact with major Hong Kong, Taiwan, South Korean and Japanese sea-air operators.

2. The nature of the cargo consisted mainly of ready made garments, shoes, scientific and precision equipment, artificial jewellery, toys, electronic goods, computers, TVs/videos, machinery and spare parts.

3. Sea-air movements from the Far East to Europe used six transfer points. The western route via Seattle, Vancouver, Los Angeles, and the eastern route via Hong Kong, Singapore and the U.A.E.

4. The airports of destination included the main gateway cities of Europe: London, Paris, Brussels, Amsterdam, Frankfurt, Rome, Madrid, Athens, Geneva, Copenhagen, Zurich, Basel, Hamburg and Dusseldorf.

When geographic locations render equal transit time, the choice of one specific location vis-á-vis another depends on the decision of the sea-air operator. On the other hand, the consignee's decision to have goods at his disposal within a specified period of time, may be governed by factors other than the total cost of the journey in relation to time, such as the transport equipment itself, which serves, in addition to its role of transporting cargo, as a form of free-of-cost storage - a measurable convenience for shippers and consignees in relation to the required transit time of the whole journey.

Therefore, geographic location takes on a further marginal dimension in its importance to consignees and shippers, not only in terms of longer or shorter transit times, but in terms of a free cost of storage.

The 'FETA' case study further highlighted the geographic location in relation to transit time by citing another sea-air transfer hub on the eastern route, namely that of Singapore, showing much shorter transit time than both Seattle and the U.A.E. ports, at much higher costs (Table 77 below).

Table 77: Transit time and cost of sea-air transport
Far East to Europe on the eastern route via Singapore

Ports of origin	Transit time (days)	Cost/kg (US$)
Japan	9	2.75
Korea	8	2.75
Taiwan	8	2.75
Hong Kong	7	2.75

Source: FETA research released in March 1988 at their Singapore annual convention

The high cost of the sea-air mode via Singapore is basically due to the much higher air freight cost from Singapore to Europe, while the ocean sector costs from the ports of Japan, Korea, Taiwan and Hong Kong, to Singapore, are common rated. The importance of time, in as far as the geographic location is concerned, is clearly defined. The faster the speed of delivery, the higher is the cost of transport, and the shorter is the distance in terms of time. See Chapter 8, Section 8.1 on 'Optimum Port Selection'.

7.2 Government rules and regulations

In this section, government rules and regulations are analysed as a characterising feature of a sea-air transfer hub, in order to assess how the flexibility of government rules and regulations can contribute to the emergence of a successful sea-air hub.

Government policy differs from country to country as regards to the transport system. Most governments are in control of sea ports, airports, ocean routes, air routes, motorways and communication systems. The primary concern of any government is the direct impact of its transport policy on the citizens, the objective being the welfare of the people. Government intervention is analysed on two major levels, the local level and the state level, covering national and international policies.

7.2.1 The local level

Local governments apply restrictions on the dimensions and size of road transport vehicles[1] for safety reasons. This became necessary in the 1960s with the introduction of long and extra long vehicles on the roads and motorways. The vehicles in question consisted of a tractive unit pulling a 40 ft or a 45 ft trailer, carrying standard-sized containers from the cargo terminals of the shipping lines, to the warehouses and storage areas located deep inside the country.

Movement of long vehicles on the roads and the motorways became frequent and dense, with the increase in demand for door deliveries and ex-factory export handling.

The increased demand led to increased pressure on the operators, for higher efficiency in terms of lower cost. To move goods in containers to and from container yards or ex-factory to the gateway port of export, or from ports of entry to end users, two 40 ft flat bed chassis, switch-locked together, then loaded with two 40 ft containers and pulled by one tractive unit, were introduced to achieve economies of scale. This increased the hazards on motorways, which witnessed up to 90 ft long vehicles, moving fast to/from warehouses and factories within the country.

1. In the U.K., legislation on the Heavy Commercial Vehicles (Controls and Regulations) Act of 1973 gave local authorities greater powers to control and regulate truck movements. In 1980 the 'Armitage Report' recommended that restrictions on truck movement should not be imposed without corresponding road improvements such as by-passes and widened carriageways. Refer: Lorries, People and the Environment (Armitage Report HMSO, (London) 1980.

The rate of road accidents and resultant injuries to people increased sharply, and led local governments to introduce restrictions on the dimensions of transport vehicles. Many countries restricted the length of their vehicles to a maximum of 45ft, the width to 8ft, and the height to 16ft[1]. However, new, wide and fast motorways were constructed in the 1960s and 1970s. Narrow lanes were also introduced to allow an increasing number of vehicles, passenger cars and trucks to move simultaneously on these motorways.

There were further restrictions on the payload of the transport vehicles. The carrying load capacity on a 40 ft container was limited to 22,000 kgs. The tractive unit and its empty 40 ft container chassis weighed between 22,000 to 23,000 kgs. Therefore, the maximum gross weight permissible on roads and motorways was set at 44,000 - 45,000 kgs. This meant that only 22,000 kgs of goods could be transported in a 40 ft container. It was justified on the grounds that higher loads tend to spoil the roads, in particular the asphalt, and this in turn created ruts, which meant increased maintenance costs to governments, together with the roads themselves becoming a nuisance to motorists.

Further restrictions were introduced because of environmental reasons. The green revolution in Europe and the emergence of environmental pressure groups led to governmental measures to preserve nature by introducing strict regulations in favour of reducing carbon di-oxide emissions of vehicles on the roads, rules to monitor filters of diesel engines, and in some countries, a complete ban on their use.

Further, as tourism became more and more important to economic development and the well-being of the people, measures were adopted to attract more tourists. Spain, with a population of 55 million, attracts 50 million tourists a year. 70%[2] of them tour Spain in motor vehicles and buses.

Rules were introduced favouring tourism, at the cost of further restrictions on the movement of heavy transport vehicles to certain hours of the day and night. A complete curfew at weekends[3] was even introduced to allow tourists to drive without any inconvenience of the long and heavy-duty transport vehicles. The impact of all these rules and regulations was reflected in the higher cost of moving cargo and a longer time of delivery.

Government regulations at the local level, are related to the sea-air hub in the following manner: most ports are situated near the airports. In many cases, approximately 40 miles separate

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1. In the U.K. maximum weights and dimensions for the commercial vehicles are contained in the Motor Vehicles (Construction and Use) Regulations indicating the maximum vehicle length, width, weight, wheelbase, chassis and other equipment. The permitted maximum gross weight of goods vehicles (cargo carrying vehicles), depend on the wheelbase length, number of axles and the spread. Gross weight includes the weight of the vehicle and the load, together with the weight of the driver and the fuel tank. Refer: Motor Vehicles (Construction and Use) Regulations HMSO (London) 1978.
2. Spanish 'Ministry of Tourism' (1992 - 1993) statistical figures indicate that 15 million tourists, per year, land in Spain via the airports and ports, while 35 million tourists arrive by road using private vehicles, public buses etc.
3. 'A Guide to Goods Vehicle Driving Hours' Department of Transport (London) 1990.

the airports from the sea ports. These 40 miles of motorway should be free of restrictions, such as curfews, which are mandatory in some parts of Europe at weekends, in order that the intermodal operators are able to deliver the goods quickly, at any time during the day, and on any day of the week. Therefore, other things being equal (in terms of port facilities, airport services and cargo handling), it is the motorways with the least transit time which contribute to a continuous flow of sea-air cargo, and thus, to the success and reliability of a sea-air transfer hub.

Therefore, the awareness of local authorities and governments of the value of providing 'free of restrictions' road links between ports and airports converts a sizeable portion of truck traffic from the main roads, thus minimising the impact of noise, pollution and congestion on main road traffic.

7.2.2 The state level (national and international):

In laissez-faire economies, governments restrict intervention to national issues that have a direct impact on the well-being of its people. The free flow of foreign capital to various sectors of the economy is motivated by the degree of liberalisation in that economy.

In the transport system, minimal government intervention in the rate structure, and the free interplay of supply and demand to determine the rates of various transport modes of the system, becomes a major consideration in the attraction of foreign capital flow. Foreign capital flow into the transport system helps generate multinational corporate activities. New investments motivate entrepreneurs and operators of a certain transport mode to introduce new technology that results in the reduction of the general costs of transport and in the improvement of 'in time' deliveries.

Besides, governments may intervene positively to attract foreign capital inflow. For example, governments may allocate certain international routes to international carriers without adversely affecting the routes of the national carriers, or they may even open the doors of national carriers for foreign investments and therefore, embark on the globalisation of the whole system. The adoption of one vis-á-vis the other will have a direct effect on the level of demand for transportation services, and, therefore affect the organisational structure of transport operators.

On the other hand, governments may intervene when operators of a certain mode of transport and the operators of various modes, decide to merge; mergers within a mode, and mergers among various modes result in the emergence of monopolies. Monopolies in the transport system are said to render a generally poor service at a comparatively high cost. In this respect, government intervention to prevent the emergence of monopolies, is welcomed by the public and foreign investors, thus retaining the competitiveness of the economy.

By the same token, the application of preferential tariffs on the entry of certain goods may encourage the flow of those goods into the country and improve demand on the transport system, while imposition of higher tariffs may discourage the inflow of goods and depress demand. Although the transport system altogether has a marginal effect on the general trend of economic growth, any changes in the demand and supply of goods will have an immediate effect on the structure of the transport system and its various modes.

The relation between government and transport systems takes on a two way dimension. On the one hand, the choice of certain options by the operators of various modes of transport (such as the emergence of monopolies) may invite government intervention, while on the other hand, the imposition of certain rules and regulations by the government, may invite the operators and the public either to accept these rules or oppose them by applying pressure through lobbying, strikes, demonstrations and the like.

In relation to the reliability of a sea-air transfer hub, state level intervention at the national and international level should be minimal, allowing the free interplay of supply and demand to determine the rate structure of all three modes of transport, operating to and from that hub.

Chapter 8

The transfer hubs

8.1 Sea ports

8.1.1 Sea port facilities

The concerns of this study are the facilities required from a port, for the successful application of sea-air intermodality. A detailed description of sea-air cargo movements, from origin to destination, helps demonstrate the exact facilities required from a port assuming the role of an efficient and viable transfer point.

Sea-air cargo moves between the Far East and Europe via two main routes, the western route and the eastern route. The U.A.E. ports are selected as a transfer point on the eastern route, while the North American Port of Seattle is chosen on the Western route. Sea-air cargo is monitored from origin to destination via these routes, with comparative analysis of both ports.

Sea-air cargo is loaded ex factory in the Far East, either LCL[1] or FCL[2]. LCL cargoes are consolidated, i.e. many shipments are put together to fill a 20 ft or 40 ft container, while FCL is one single shipment occupying the full space of a container. A B/L[3] is issued for each shipment showing shipper/consignee, nature of cargo, number of packages, origin and destination. An invoice and packing list accompany the shipment during its journey to the transfer point.

Sea-air cargo, in containers, is loaded on ships last, at ports of embarkation, in order to be offloaded first on arrival at the port of transfer. This is required because other containers onboard ships are not subject to immediate and fast transfer to the other modes of transport. As the ship approaches the port of transfer, immediate berthing and immediate facilities to offload containers on to container quays are required.

The mechanics of the sea-air operation is analysed as follows: A single 'Bill of Lading' is issued by the sea-air operator from the port of origin to port of transfer, and consigned to a multimodal operator. On loading containers at the port of origin, the sea-air operator pre-alerts the consignee[4] at the port of transfer with the details of the incoming shipment, such as the expected time of arrival plus other details as per the bill of lading.

1. LCL : Less than full container load
2. FCL : Full container load
3. B/L : Bill of lading.
4. Consignee : Multimodal operator at the transfer point.

In the past, the telex was commonly used. In the last decade, facsimile and electronic mail use replaced telex communications. B/Ls, invoices and packing lists are now faxed, or electronically mailed to the consignees at the port of transfer long before the ship's arrival, allowing ample time to make preparations for immediate transfer of sea-air cargo from on board ships to on board truck trailers bound for the airport for air carriage to final destination. This operation is completed within 12 hours of the ship's arrival and applies only to FCLs (Full Container Loads) consigned to one consignee, while LCLs (Less than Full Container Loads), i.e. consolidations, must first move from the port to the de-consolidation centres of that port, where break-bulking[1] of the containers take place, and each shipment is segregated from the other, re-marked, re-labelled, re-numbered and each carried to the airport where an airline waybill is issued for each consignee and each destination.

A pre-alert is sent to the consignees at destination, advising of the arrival time and date. The same information is communicated to the shipper at origin. The sea-air operator controls the flow of cargo from arrival at a transfer port to arrival at the consignee's airport.

Port authorities require the invoice, packing list and ship's manifest for inbond customs clearance. In the U.A.E., port authorities require a bank guarantee of US$ 80,000 to be supplied by the sea-air operator. This ensures that sea-air cargo customs cleared inbond remains so for the rest of its journey, to the airport of final destination. The inbond customs entry form must tally with the airport customs exit form, and once tallied the transaction is closed. This whole operation is linked by custom's central computer.

The differences and similarities in handling costs and procedures between Seattle/Tacoma port and the U.A.E. ports are:

1. Both ports are equipped with the most modern handling equipment available today, including more than 25 gantry cranes, miles of container quays and vast areas of container terminals and container warehousing on chassis[2].

2. The availability of low cost labour in the U.A.E. (labour from the subcontinent of India, Pakistan and others), together with the availability of vast areas of inexpensive land around ports make warehousing, storage and container terminals less costly than Seattle/Tacoma, and certainly less costly than most sea-air ports of the world. For the end user, what matters is the cost per kg and a short transit time from origin to destination. The average cost of handling a kilogram of freight at the U.A.E. Ports is

1. break-bulking — Less than FCL are separated into individual shipments. Each shipment has a different consignee, and a different destination. While a FCL also undergoes the same process of relabelling, if addressed to one single consignee and one single destination, this results in saving transit time.

2. chassis — 40 ft and 20 ft mobile chassis exactly similar to 20 ft and 40 ft flatbeds but with no flat beds. Chassis are specifically used to load only standard containers, while flat beds can load containers and bulk cargo.

within $0.03/kg[1], while the average cost at the Port of Seattle is $0.05/kg[2].

3. The Port of Seattle assumes full responsibility for consolidation/de-consolidation and control of cargo flow up to delivery. The ports of the U.A.E. do not offer such a facility and are not yet involved in the logistics of container break-bulk or consolidation. They are presently constrained by their own rules of operation or by government restrictions. In the U.A.E., all consolidated cargo is either offloaded at the ports of Dubai or Sharjah, or hauled overland from any other U.A.E. port to either ports' de-consolidation centres, operated by the shipping lines. LCL transit time is 1 to 2 days in the case of Seattle and 2 full days in the case of U.A.E.

4. In both ports, sea-air cargo arriving in full container loads and consigned to a single consignee (sea-air operator/freight forwarder) is custom cleared and trucked in bond to the designated airport, with hardly any stoppage.

5. In the U.A.E., APL (American President Lines) uses Fujairah Port, 160 kms away from Dubai and Sharjah, as its hub. APL absorbs all the overland cost of transporting LCLs to the ports of Dubai and Sharjah, while direct deliveries of FCLs to the airports of the U.A.E. are charged only 25% of the standard trucking cost. It must be noted that LCL cargoes are trucked from the de-consolidation centres at the ports to the airports at an average cost equivalent to the FCL 25% charge for direct airport delivery. This brings LCL cargoes on a par with FCL as far as the cost of overland transport is concerned.

The role of a port in the transport system is directly related to services performed for ships, cargoes and overland transport systems. Intermodal transport altered the role of ports from a break-bulk and terminal point to an expanded role as a fundamental link in the total distribution chain. The concept of intermodality has reduced the importance of some of the conventional services and created new functions for sea ports.

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1. & 2. average cost figures were derived from interviews with the U.A.E., Seattle, Los Angeles sea-air freight forwarders as follows: official charges as per port's tariffs at U.A.E ports are :
US $ 121.60 per 20 ft container including delivery order fee.
US $ 173.50 per 40 ft container including delivery order fee.
Average payload in kilograms of sea-air cargo in 20 ft containers is assessed on air freight volume ratio applicable from Dubai and Seattle of 6:1 (see footnote on page 49) to average volume usable capacity of 28cbm or cubic metres, i.e 28 + 6 = 4667 kgs, and exactly double this figure for a 40 ft container. Therefore average cost per kg is :
20 ft container US $ 121.60 + 4667 kgs = US $ 0.026/kg.
40 ft container US $ 173.50 + 9334 kgs = US $ 0.019/kg.
While LCL cargoes are charged differently, US $ 4.10 per cbm plus a delivery fee of $ 13.66 per consignment or bill of lading. The average LCL shipment = 2 cbms, or 334 kgs. Applying the air freight ratio of 6:1, each cbm = 167 kgs, therefore average cost per kg (LCL basis), is :
$ 4.10 + $ 13.66 + 334 kgs = $ 0.053/kg.
By application of research findings that sea-air cargo arrives to the ports:
20% in 40 ft containers FCLs
40% in 20 ft containers FCLs
40% in LCLs
so 20% x 0.019 = 0.0004
40% x 0.026 = 0.0104
40% x 0.053 = 0.0212
0.0320
This figure was rounded to US $ 0.03/kg as cost for U.A.E. ports. At Seattle/Los Angeles ports terminal handling charges are 65% more and a figure of US $ 0.05/kg was found to apply.

Many ports have started to offer extensive consolidation services to shippers and shipping lines. Since full container load shipments represent just part of the total container load, small consignments from various origins and bound for different destinations, and consigned to various consignees in different locations, but all via the same port, need to be consolidated into full containers in order to reduce costs of transport.

The Port of Seattle's most significant contribution is in the field of consolidation as seen in advancing high volume, fast moving, longer range, intermodal journeys. The speedy handling of Full Container Loads at the port may not yield an advantageous large scale intermodal flow, while consolidation and de-consolidation centres at the port extends the activities of the port, to include the logistics of a freight forwarder.

The de-consolidation centres provide just the service required by the sea-air operators at a transfer point. According to the findings of this research, approximately 40% of sea-air cargo arrives at a transfer port consolidated in less than full container loads (LCLs). The need to de-consolidate and segregate each individual shipment, and the preparations that follow to make each shipment ready for air carriage, in the shortest possible 'break bulk' time becomes of crucial importance to the continuous flow of sea-air cargo to the final destination.

In this respect, the 'Sea-Air Operator's Association' of the U.A.E. (SAOA) has already made proposals and recommendations to the 'Ports and Customs Authorities' of the U.A.E. to introduce de-consolidation centres at the airports, and allow direct deliveries of LCLs, so that 'break-bulking' occurs at the airport rather than at the port. Another related proposal by 'SAOA' to the Port and Airport Authorities of the U.A.E. was to investigate the possibility of introducing a standard sea-air entry and exit form to apply to all ports and airports of the U.A.E.

<u>8.1.2. Port selection strategies:</u>

The development of container vessels, together with the expansion and upgrading of many world ports, within certain geographic regions, lead the shipping lines to make strong selections of certain ports vis-á-vis others. The concentration of the container services to certain ports in a specific region was meant to achieve the greatest possible productivity of employed resources, i.e. the container vessels. 27%[1] of all port calls are concentrated around ports in the Far East and one port in Europe. Also most of the world container traffic and container tonnage is concentrated around those same ports.

Appendix J shows the degree of concentration of world container traffic and its tonnage, at 25 selected ports by rank of the

1. As per ISL merchant fleet data bases and aggregates based on quarterly updates from Lloyd's Register of Shipping/LMIS, Lloyd's Voyage records and containership data from MDS Transmodal, 1992/1993.

world's 250 busiest ports[1].

By the end of 1992, total container traffic of the 250 ports reviewed, was approximately 80.5 million containers, and the tonnage was approximately 840 million tonnes.

10%, or 25 ports, of the 250 busiest world ports control 65.6% of world container traffic and 68.7% of its container tonnage. The Far Eastern region leads the rest of the world with 42.5% of total container traffic and 43.5% of its tonnage. On the other hand Europe and North America share among themselves slightly less than a quarter of the world container traffic and 25.2% of its tonnage. This trend is expected to continue strongly through the rest of this century.

The consequences of such a regional concentration of services encourages the reduction of port calls, which further means that the possibilities of many shipping lines integrating their services into a common service from/to very few ports, may give rise to certain aspects of a sectorial monopoly and, therefore, serve as a strategic alternative to the formation of a consortium.

The key to this possible consequence is the selection of certain ports to serve the combined regional services of shipping lines. Port selection strategies are subject to three main models:

1. <u>The single load centre strategy, the 'hub' port</u>:

   Such a port should be able to provide adequate intermodal handling facilities to connect all containerised cargo with overland transport to and from further points deep inland, including industrial consumers' centres in addition to major airports of the region. At the same time, this single port should be provided with numerous ocean feeder services covering the movement of containerised cargo from/to various ports of the region.

2. <u>Multi-port strategy</u>

   This strategy means that at least the main ports of the combined geographic region will be called on direct and not through feeder vessels. As such, the feeder services are reduced to a bare minimum. Further, under this strategy, overland intermodal services deep inland operated by the shipping lines, for either pick up or delivery of container cargo, are reduced practically to the location of the container terminal around the ports. In this case, a return to conventional shipping days, whereby each port was served directly, and assumed its own independent captive area of cargo movement.

1. Based on ISL Shipping Statistic Yearbook of October, 1993 - Bremen Institute of Shipping and Logistics. The figures were derived from a total of 250 ports' statistical data (1987 to 1992), as tabulated by ISL. 1992 figures were adopted for this analysis because 1993 and 1994 figures were derived from relatively less reliable sources and periodicals.

3. <u>A combination of strategy 1 & 2</u>

   This model is considered by many observers as the most commonly used model today, as it seems to be an acceptable compromise to strategy 1 and 2.

Port selection strategies are subject to many factors in addition to the general characteristic of the port itself. Ports may be characterised by their physical nautical limitations such as that of draught; others may be restricted by their own cargo and container handling facilities. Therefore, first a short list of world major ports with adequate nautical approaches and facilities can be drawn up, then, a further analysis of the logistic systems of these ports is apt to reduce further, and substantially, the first short list. As world port authorities are increasingly under pressure to provide logistic facilities for the shipping lines calling at their port, the evolution of the shipping line role from a 'port to port' carrier, to a 'door to door' carrier entails that ports called should have :

1. Adequate transfer systems to transfer containers from onboard ship to onboard truck or rail for further carriage to points deep inland, or to nearby airports for further on-carriage by air to final destination;

2. Adequate communications and data base systems enabling the shipping lines to practice control over the movement of their containers from/to the port, the container terminal and points deep inland;

3. Moderate and reasonable port related charges;

4. Adequate container and cargo handling facilities, together with the availability of skilled labour during working hours and outside working hours;

5. Availability of numerous berths and large container terminals to accommodate all sizes of fully cellular container vessels and the ability to act as a redistribution centre for the whole region through sea borne feeder services and overland links; and,

6. Availability of efficient motorway and/or rail system connecting the port with various densely populated consumer and industrial areas, as well as the main airports in the region.

The present phenomenon of hubbing and the trend for a single load centre, a 'hub', having all the requirements as detailed in the six points above, is accepted by many world major carriers and is being tested constantly. Lately, APL invited the North American West Coast Ports of Los Angeles, Long Beach, Oakland, Seattle & Tacoma to work out together a proposal or a concept under which all five ports were asked to provide a 'single' load/offload centre for APL, covering all the West Coast.

In February 1993, the plan was cancelled due to many reasons. The main one was the difficulty of covering a distance of 1600 kms of West Coast shore line, dotted with five ports equipped with almost equally adequate and efficient logistic systems. The difficulties were manifested by shippers and consignees' responses to the APL proposal within each port's range of its 1600 kms radius, covering the West Coast as well as inland industrial and consumers' centres. The majority of shippers and consignees gave a negative response to the APL proposal of a single load centre. They were simply afraid of longer transit times for their cargo.

The proposed APL plan shows that the selection of a certain port is so relevant to the shipping line productivity, and, at the same time, shows clearly how sceptical and indecisive the shipping lines are when considering a port selection strategy. However, the negative response that was demonstrated by the shippers and consignees was a response to only one single aspect of a complete chain of land-sea-land logistics, and that is the possibility of delays and longer transit times to their cargo. This factor could have been overcome by APL's commitment to shorter transit times and lower total shipping costs, which are bound to occur under a single load centre strategy. However, what deterred APL was largely the opposition from all five West Coast Port Authorities, and the US Government ruling, through their FMC, against the possible emergence of sectorial (anti competitive), mega-size monopolies that could involve shipping as well as overland railway and trucking systems, and, therefore, endanger the competitiveness of all concerned parties.

Port selection is only one aspect of a series of intermodal transport knots that starts at origin, ex-factory, to consignee's door, and which are not just subject to shipper or consignee's proximity to the port that is served direct by the shipping line.

Slack[1] confirms that : "on the basis of the results of a comprehensive survey undertaken by 'World Cargo News' in the first quarter of 1984, in USA and Europe, the shippers select their logistic partners by evaluating the whole service and not by substantial consideration to a single component like a port which might be called direct or not"

Further, Brooks[2] ascertained that based on an analysis of a survey conducted in Europe and the USA in 1989, the majority of shippers and consignees answers to questionnaires were grouped as per the importance of certain defined criteria in the selection of a carrier. Reliability came first with almost 100% of the answers, while the great majority confirmed that the most important considerations, besides reliability were:

1. The cost of service;
2. The sailing frequency; and,
3. The transit time.

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1. Slack B. - Containerisation, Inter-port competition and Port selection. Maritime policy and management Vol 12. No. 4 1985, pages 293 - 303.
2. Brooks M. R., Ocean Carrier Selection - criteria in a new environment. Logistic and Transportation Vol. 26, 1990 No. 4, pages 339 - 355.

Therefore, factors determining the selection of a certain port, in relation to the three main port selection strategies, are:

1. The demand side :

As expressed by shippers and consignees, the basic demand for the reliability of any service is taken for granted because of its fundamental and crucial importance to the survival of that service, followed immediately by its cost, frequency and transit time. These three factors are inter-related and vary in the context of each of the three strategies.

Under the single load centre strategy, the 'hub':

a. Costs of shipping to shippers and consignees can be reduced by the shipping line with the use of larger container vessels which can accommodate larger volumes of containers, and, therefore, generate higher levels of revenue.
b. Transit time can be reduced through higher frequencies of sailing, and becomes a factor of sailing frequencies. The more frequent the sailing, the shorter the transit time. Thus, the frequency of sailings becomes much more important than short transport time of direct shipping between any two ports, or between a multiple of ports, because less frequent sailings result in longer average waiting time, or stay time at port of origin[1], which in turn means longer transit time from origin to final destination.

Under the multiple port strategy:
It should be noted that the failure of APL's plan for a single load centre, of direct calls to/from one port meant the retainment of its multiple port strategy of multiple direct calls, to and from major ports of a certain geographic region, and also meant much less container handling and much less use of feeder services, both being the basic factors that accompany the single load centre strategy.

Nevertheless, APL was able to maintain the same costs and transit time to shippers and consignees, as it did before the proposed single load centre. The savings derived from less container handling and less use of feeder services, due to the absence of massive container transhipments, did partially compensate APL's increased costs, resulting from the application of a multiple port strategy.

However, under the multiple load strategy, APL was neither able to reduce shipping cost nor transit time to shippers and consignees. Therefore, demand is not really affected by a change of a component (such as a port) in the whole transport chain, provided that the cost of service and the transit time remain the same, or are improved from that which existed before the change.

1. APL and Maersk Lines each maintain a single sailing frequency, every three and six days, respectively, from Hong Kong to Dubai. Shipping time port to port (water time) is 12 days for both of them. Shipments received by APL in Hong Kong will have an average delivery transit time of the three day frequency median, plus the port to port shipping time is (50% x 3) + 12 = 13.5 days. By the same token, average delivery transit time for Maersk is (50% x 6) + 12 = 15 days.

2. The supply side :

The basic pre-requisite of the supply side is the fulfilment of the demand side requirements. Demand remains a constant factor, before and after the change of a component such as a port, in the sense that :

a. Volume of cargo and the cost of service, both remain the same; and,
b. Total transit time remains the same.

The fulfilment of the demand side must be viewed in relation to the control of cargo flow and the maintenance of the shipping line's clientele as irrevocably essential, and, therefore, constitutes the most important factor in maintaining the stable growth of productivity and revenues.
The question that becomes pressing is: Under the conditions established above, which port is to be selected by the shipping line?

If shipping lines' revenues are assumed to remain the same due to no changes in the cost of service and the volume of cargo, then, the main criteria in this particular decision making becomes a function of costs and revenues. Shipping lines will try to reduce their cost of operations by looking at areas where costs are unnecessarily high, and by looking at the marginal contribution of the newly selected port in terms of lower costs of providing;

a. efficient facilities to receive and load volumes of container cargo, in the shortest possible time, as an 'origin port'.

b. intermodal facilities that enable fast and in time door deliveries to final consignees, as a 'destination port.

The assumption of stable revenues and costs are highly questionable under different port selection strategies:

1. Under multi-port strategy:

a. The dependence on the ocean feeder services and overland links becomes minimal, as shipping lines start calling at many regional ports with their extra-large container capacities resulting in much lower freight load factors and, therefore, lower revenues, thus adding relatively higher costs to their operations, which are proportionally higher than the ocean feeder replaced costs.

b. The reduction of the shipping line overland links to/from the location of their container terminals around the many ports of call on their schedule does in fact reduce their cost, but not to the consignees nor to the shippers, whose concern is to have the goods reach the consignee's door in the fastest transit time at the most reasonable cost.

Overland pick-up services ex factory and door deliveries to consignee's door from/to the shipping lines' container terminals, become open to many enterprises other[1] than the shipping lines. The ability of outsiders to offer shippers and consignees a complete door to door service does in fact loosen the shipping line's grip and control over the flow of cargo which may result in the diversion of traffic to other competing lines, thus resulting in lower revenues and increased operating costs.

Under a single load strategy:

Shipping lines are able to retain their control over the flow of cargo, and maintain most of their clientele through their ability to reduce costs and transit time. This is achieved through the use of extra-large container vessels, with larger container loads, thus reducing the average cost per slot and thereby saving on the general operating cost, may be reflected in offering part of the savings in the form of a marginal reduction in shipping cost to shippers and consignees. Transit time, however, may be shortened due to the increased sailing frequencies, between single ports load centres, as seen earlier.

Such a strategy reduces the role of the freight forwarder to a mere Custom House Broker at ports of origin and destination, and may even nullify completely his role, since customs clearance is today a computerised operation that may be handled by an affiliate firm such as the shipping line's General Sales Agent, at origin and destination ports.

The control over cargo flow in the port selection strategies aims at satisfying the 'door to door' demand of shippers and consignees of a certain geographic trading area. The 'door to door' demand entails the involvement in the intermodality of land - sea - land transport systems, from the time cargo is received at origin, to the time of delivery at final destination.

Ex factory ----> overland ----> port of origin ----> ocean ----> port of destination ----> overland ----> consignee's door.

Shipping lines, freight forwarders, NVOCCs and Port Authorities are all competing for control over this type of cargo flow, within certain geographic areas.

1. The other enterprises that are most likely to enter the 'door to door' market are:

a. The Port Authorities, such as the Port of Seattle, getting involved in offering shippers and consignees a 'package deal' of 'door to door' deliveries.

b. The NVOCCs and the freight forwarders (see the section on 'Freight Forwarders', section 9.3, Chapter 9).

8.2 Airports

8.2.1 Airport facilities

Airport cargo handling facilities contribute largely to the reduction of total transit time of intermodal transport. A short transit time is one of the major advantages of air transport. This advantage is derived mainly from the speed of the aircraft itself and from the speed of cargo handling at the airports.

Airports are usually constructed around major cities and are on an average, 12 to 40 miles away from city centres and densely populated urban areas. Modern, double carriage, fast motorways, fast railways, and underground transport systems connect airports with city centres, industrial locations deep within the country, the market place and sea ports.

Time saving factors of the combined sea-air journey are of primary importance for the success of the sea-air mode. Therefore, the airport's proximity to the sea port, availability of fast and low cost overland transport systems, connecting ports with airports, without restrictions, curfews and other hindrances, contribute to the continuous flow of cargo with the shortest possible transit time.

Between 1980 and 1994, a large number of 'Airport Authorities[1]', around the world were taken by surprise as a result of the unexpected increase in movements of passenger and cargo aircraft through their airports. Almost all the world's airports witnessed a surge in aircraft movements.

Appendices K-1 to K-6 are derived from data reported by more than 400 world airports and represents airports average annual increases in traffic over intervals of five year periods starting with 1980 to 1994, inclusive. Airports showing less than an 8.0% average annual increase in any of the main indicators, aircraft, cargo and passenger movements, were ignored.

To cope with the sudden increases and realising that large airports cannot be built overnight, serious studies and long term planning of many development projects become pressing, such as:

1. Availability of a proper construction site for the proposed new airport;
2. Planning;
3. Financing;
4. Construction;
5. Equipment; and,
6. Management and automation.

Such projects need ample time to execute. An average period of five to ten years is required for the construction of a new large

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1. Most airports around the world are controlled by governments who appoint bodies, or delegate authority to operate and control their activities. These bodies are called 'Airport Authorities'.

and efficient airport. While the demand by air carriers was pressing and immediate, 'Airport Authorities' resorted to implementing quick measures to cope periodically with the increasing demand. Those measures came in the form of :

1. Enlarging the present cargo terminals;
2. Expanding runways; and,
3. General re-equipment programmes.

At the same time, many 'Airport Authorities' embarked on long term plans to construct new runways, new large cargo and passenger terminals, in addition to general automation of airport operations, computerisation and modern communication systems.

The undertaking of such long term construction plans required sound financing and the availability of the necessary funds. Governments were fully involved in raising the necessary funds from various sources. One such source was the present airport and its new extended facilities. Airport Authorities were placed under pressure to raise part of the funds needed to modernise or even construct new adjacent facilities. Funds could not be raised by increasing the costs to the airlines using the airport because of competition by nearby airports who were facing more or less the same problems.

On this particular subject, Mr. Gordon Hamilton, President of Sypher: Mueller International, addressed delegates at the fourth ACI (Airports Council International) World Assembly and Conference in Marrakech, Morocco, 6 - 10 November 1994, on the topic '*Killing the Golden Goose*'. Mr. Hamilton detailed some of the taxes which are often portrayed as airport-related charges, and explained that this treatment of aviation by governments could be due to the perception that;

1. air travel is an elitist form of transport;
2. that air travellers are mostly foreigners; and,
3. that the charges are trivial, and that air travellers have no choice but to pay.

Mr. Hamilton refuted this reasoning and gave the example of Vancouver where the introduction of a new passenger tax increased significantly the number of originating passengers driving to the US to start their air travel to the US and other world destinations. This resulted in a traffic loss equivalent to 3 B737 loads per day of passengers, 394 jobs and some $65 million in economic activity.

The moral, said Mr. Hamilton, was: 'Higher travel taxes mean reduced travel and reduced revenue to the airports, and an economic loss to the community'.

The most likely acceptable option left was that related to economies of scale, and that is to attract as many world airlines as possible to use a particular airport at even lower costs, and offer as many facilities and incentives as possible, rather than applying higher taxes to the limited number of airlines using that airport. The impact on cargo movement through the decrease or increase in passenger flights is reflected in the availability or non-availability of belly-hold cargo capacities.

As efficient and new large or extended air cargo terminals became available at reasonable cost to airlines at many hub airports, authorities were further subjected to increasing pressure of a different nature, and that is to offer more incentives, in terms of less restrictions and control, to airlines using their airports. This pressure resulted in moves by numerous governments/authorities towards: (a) less economic control of the airlines and (b) less interference in the services provided by the airlines. In other words, the "liberalisation" of the airline industry.

In the 1980s, with the start of liberalisation, an increasing number of domestic airlines started a move of operating international routes. This was further reinforced and encouraged by many governments who started applying 'Free Sky Policies', during certain periods of the year, to suit their needs, such as the government of India which declares, from time to time, a 'Free Sky Policy' limited to cargo movement, allowing as many airlines as possible to clear their airport cargo congestion and the build up of backlog freight of their air export industry.

On this particular subject, the following excerpt taken from the opening address of Mr. Jack Moffat, ACI Chairman, at the fourth ACI World Assembly and Conference in Marrakech, Morocco, 6 - 10 November 1994, demonstrates the point clearly. " The US experience showed that liberalisation stimulated travel and benefitted the consumer, but that the accompanying airline concentration may not be in the consumers' long-term interest. A more gradual and phased liberalisation is being tried in Europe in an effort to avoid or mitigate some of the more unpleasant social aspects that accompany de-regulation and competition".

With the relationship between airports and airlines becoming more tenuous, many airports and their surrounding communities can no longer depend on steady air services, as airlines may close down or reduce air services from/to a certain airport, at relatively short notice. It is, therefore, up to the airport and the community it serves to attract airlines and their air services.

The transition of air transport from a mode of transport for the elite, into a mass transport mode, may spell the end of special treatment of air transport by governments, and aviation could be increasingly subjected to regulations which do not always take account of its specific features. Mr. Moffat said that "airports will have to adapt to this new environment, and ACI will do its utmost to ensure that their interests are reflected in any international policies which may result from this trend."

"Dramatic changes are now taking place in the world of air transport and can no longer be accommodated by the existing regulatory system". With this statement Dr. Phillipe Rochat, ICAO Secretary General began his keynote address on air transport liberalisation[1] and stressed that ICAO's proposed new regulatory arrangements could replace 'micro-managed' access to air transport markets, by 'macro-managed' markets as a whole. Any cities and their airports, in the territory of each party to the agreement, could be served with complete flexibility and airports would no longer be held back in the development of their air services by restrictions on most market access by airlines.

Dr. Rochat said that to facilitate market access, the proposed regulatory arrangements would allow for substantial ownership and effective control of airlines to be located in any State or States party to the agreement and/or nationals of such States, or dispense with the ownership and control test altogether if the headquarters, central administration or principal place of business of the foreign air carrier is in the territory of the designating state. Dr. Rochat concluded by hoping that the ICAO Conference, to be held in November 1995, could set in place a new regulatory framework for those who want to use it. He also predicted a process in which some States would rapidly opt for multilateralism, while others would gradually liberalise their existing bilateral agreements.

Some states went much further than Dr. Rochat's expectations and predictions, and much further than the US liberalisation and declared a permanent 'Free Sky Policy' with no restriction on any 'Freedoms[2]' to the airlines. Such was the case of the U.A.E. airports, namely that of Dubai, Abu Dhabi, Sharjah and Fujairah. Many other airports in the Arab Gulf region, such as Oman, Bahrain and Kuwait followed suit, but with varying degrees of liberalisation.

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1. Presentation made at the fourth ACI World Assembly and Conference in Marrakech, Morocco, 6 - 10 November 1994.

2. <u>**Freedom**</u> :
Market access in air transportation is not a free-for-all. It requires an operating license & traffic right. Both are granted by the airline's country of registration. The operating license is a permission to form an airline. Traffic rights are an authority to fly traffic routes domestically and/or internationally. Awards to fly traffic routes are granted for 'scheduled' flights or charter flights. The scheduled flights are entitled to carry passengers and/or cargo on common carriage basis. The charter flights are limited to the carriage of single-entity loads, (an affinity group of passengers, and a single load of cargo shipment). Of late however, the stress on single load for cargo charters has been relaxed by governments, especially on routes involving 'Open-Sky' countries.
To grant traffic rights to a foreign country, the government must have concluded earlier a 'Bilateral Air Agreement' ('Bilateral') with the foreign country concerned. The 'Bilateral' is, in capsule form, a political accord, - which has the force of a trade treaty - regulating capacity and conditioning ownership, nationality and operational safety requirements between the two countries. A national airline must have majority shareholding in the enterprise.
Bilaterals are governed by the Chicago convention of 1944. This convention divides the latitudes to cross international borders into five freedoms of the air.
The five freedoms of air are **negotiated in bilateral air services agreements** and defined as follows:

First Freedom -	the right to fly over another country without landing.
Second Freedom -	the right to make a landing for technical reasons (e.g. refuelling) in another country, without picking up/setting down revenue traffic.
Third Freedom -	the right to carry revenue traffic from country A to the country B, of treaty partners.
Fourth Freedom -	the right to carry traffic from country B back to your own country A.
Fifth Freedom -	the right of an airline from country A to carry revenue traffic between country B and other countries such as C or D. This freedom cannot be used unless countries C or D also agree.

Supplementary rights
Sixth Freedom - the use by an airline of country A of two sets of third and fourth freedom rights to carry traffic between two countries but using its base at A as a transit point. For example, Royal Jordanian carries sixth freedom traffic between London and Middle East points via its base at Amman, even though it has not been granted fifth freedom rights between these points and London. Sixth freedom rights are not formally recognized in air services agreements, though several confidential memoranda of 'understanding' make implicit reference to them, especially when dealing with capacity issues.

Many airlines took advantage of the 'Free Sky Policies' and started operating these routes on demand and at very competitive rates. Competition among airlines, especially cargo airlines, became fierce and deadly, eventually resulting in many cargo airlines[1] disappearing from the market place.

The advantages of the 'Free Sky Policies' and the competition that emerged with it, were reflected in:

1. an increased demand on air cargo capacities and on air carriers to provide the required cargo capacities.
2. a continuous pressure by the users to decrease the cost of air cargo carriage, a factor that forced the airlines to rationalise their services or disappear from the market place. Rationalisation meant concentration of airline frequencies to certain high volume major routes, resulting in dense frequencies between certain airports and light frequencies between others.

The immediate disadvantages were felt by airport authorities on major routes, as the increased demand led to congestion of cargo terminals, and inevitable delays, setting the scene for bitter complaints and growing pressure from carriers, freight forwarders and the users, to improve and expand the then available facilities, putting the blame on Airports and its Authorities.

Airport Council International officials recognised the long term need of many airports for increasing capacities in order to accommodate the continuous air traffic growth. Temporary measures of upgrading which led to much more efficient use of existing facilities were not enough to ease congestion and delays. One prominent ACI official attributed the failure to political factors. ACI Director General, Oris W. Dunham Jr. in his presentation 'New Airports and the ability of present airports to cope with future traffic levels' (Air Traffic Control Conference held in Maastricht on 22 - 23 February 1995) highlighted the numerous new airport projects and improvements to airport infrastructures around the world. He also emphasised the physical, economic, regulatory and environmental barriers faced by the airport community and the entire aviation industry.

Dunham said that despite all the efforts by the airport community to solve the capacity problems, the battle was very much in the air. "Only political will on the part of governments should lead to a viable solution to the chronic flight delays at many airports, delays which are often attributed to airports but which are in fact caused by factors well beyond their control, such as saturated ATC (Air Traffic Control) systems and industrial disputes of ATC and airline personnel" said Dunham. He added that with new aircraft orders amounting to around US$ 800-900 billion over the next 10 to 15 years, infrastructure investment required funding of about US$ 450 billion. However, despite the difficulties, "airports are willing to take up the economic

1. In the 1980s, the main growth in cargo capacities came from the introduction of wide-bodied pax aircraft rather than all cargo aircraft. In fact the share of total world air freight of all cargo carriers declined during this period, and many all cargo airlines went out of business, e.g. 'Seaboard World Airlines'. More details follow under the section entitled 'Air carriers'.

challenge of providing facilities for traffic growth. Local authorities should be willing to give clear support to such investments, which create jobs and wealth" said Dunham.

In fact, Airport Authorities and their governments have been continuously involved in expansion and construction plans that practically developed into a trend that started in the early 1980s and is still growing up to our present time in March 1995:

1. the construction of new, large and efficient airports;
2. the expansion of old passenger and cargo terminals;
3. the construction of cargo villages around airports and within their bonded areas;
4. the expansion of runways; and,
5. the renovation of old air traffic control systems, communications, data base and booking systems.

World Airport development plans are announced and published from time to time. To cite a few examples covering all six world regions' airports development plans, as announced through various ACI publications in September 1994 and March 1995.

Among other airport facilities that should be provided rather immediately, and updated constantly, is the provision of a central computer system, for all airlines to participate in, in order to offer cargo bookings on various flight schedules. This becomes a necessity when many airlines use the same airport. The presence of many airlines at a certain airport gives rise to an immediate and simultaneous development, namely that of the General Sales Agent, the Sales Agent, the freight forwarder and eventually the sea-air operator, who in turn generate an additional demand for cargo bookings.

The most significant facility that an airport should provide is the ability to handle massive movements of cargo in the shortest possible time. This calls for investment on the part of the authority looking after the airport, in areas of expanding cargo terminals, modernising runways or even building new airports with new cargo terminals and adequate runways to deal with increased traffic flow. Even with the airport services becoming efficient, the efficiency of the sea-air system will not be at its best, unless it is backed up by equally efficient facilities elsewhere.

For example; assume a sea-air cargo movement during weekends (an assumption close to reality). It moves from the sea port to the airport on supposedly fast and reliable motorways with easy and clear access to the airport cargo terminals. This cargo is assumed to arrive in large volumes, at sea-air transfer ports on weekends or one day before a weekend starts, i.e. on Fridays/Saturdays (similar to Seattle and Vancouver port arrivals), for eventual air carriage on pre-planned freighter flights scheduled to depart during the same period. This kind of frequency is a planned frequency, and manifests co-operation between the two major modes of transport involved in the sea-air movement; the shipping lines and the airlines. Weekends are considered dead time for the consignees, the end users. Its effect on the total transit time of the sea-air journey is irrelevant in the sense that if a ship is carrying sea-air cargo and arrives at a transit point on Thursday, or even a Friday, and assuming the sea-air cargo is moved immediately and within hours from the ship's arrival to the airport, the cargo could be loaded on airline flights departing from the transfer point on the Friday itself. The mere arrival of goods by air, at an European airport of destination, on a Friday noon or afternoon, makes it very difficult to custom clear and deliver any consignment during a European weekend. Most consignments, if not all, arriving on a weekend, are custom cleared and delivered to end users during the early working hours of Mondays.

The scheduled and planned arrivals of ships to sea-air transfer hubs, just one day before the start of an European weekend, entails a massive movement of sea-air cargo in containers from ports of entry to airports of exit, within the short period of the weekend. This means that a sea-air hub airport should be able to provide:

1. Large areas and numerous bays for the offloading of containers, and large parking areas for trucks waiting their turn to offload.
2. Large areas to facilitate container load segregation and hence immediate build-up of airline pallets.
3. A 24 hour delivery and acceptance cargo service.

Since the airline's main concern is a fast turnround at airports, and as many airlines will want to be loaded in a very short time span, the airport is pressured to provide further facilities, such as:

1. The availability of trained cargo handling staff at the airport, equipped and ready to handle successive loads, during the weekend, makes it easier and faster, to re-label, re-number, re-weigh and palletise cargo, to be ready for carriage on the designated flight to the airport of destination;
2. A sufficient number of electronic scales to weigh loaded pallets and cargo loaded in airline unit load devices;
3. Proper and sufficient aircraft cargo handling equipment such as, automatic conveyors, high loaders, fork lifts and the like; and,
4. Ability to move and handle goods inbond without undue paper work or delay.

As many shipments are increasingly small individual shipments, and given that a small shipment cannot qualify for a full container load, then small individual shipments, termed as LCLs, (Less Than Container Loads) are grouped together to fill a container at origin. As this container arrives at the port of entry, at a sea-air transfer hub, it must be trucked overland to the airport of exit within the shortest possible time. A large enough area should be made available for the de-consolidation of LCLs at the airport, to facilitate the break bulk of various consignments, and the preparations that follow. Preparation such as, re-labelling and re-numbering of each package in the consignment with its particulars, and then the palletisation of these individual consignments to 'ready for carriage state'. This facility is increasingly demanded by the sea-air operators.

The major hindrances as far as reduction of sea-air transit time is concerned, are: (1) the emphasis on security as a result of terrorist activities, throughout the world, using aircraft and airlines for malafide intentions. As a result, airlines/airports apply a 24 hour cooling period after receipt of cargo. (2) an increase in sea-air cargo flow causes delays and congestion and (3) the adverse climatic conditions (such as high temperatures), cause airlines to restrict their payloads on take off, by last minute offloading of cargo. Further analysis of these points is made in section 9.3 under 'Freight Forwarders'.

8.2.2 Airport selection strategies:

1. Sea-air cargo is considered an offshoot of high volume and highly concentrated sailing frequencies between a few ports in a certain geographic trading area. It is attracted to these routes because of their short transit time and low shipping costs, and, therefore, 'diverted' temporarily to an intermediary port, other than the port of destination of its original all ocean route. The highly concentrated ocean routes between the Pacific Rim ports of the Far East and the ports of the North American West Coast are meant for cargoes destined to the North American region. Sea-air cargoes diverted to ports on these high volume routes, transit North American ports and continue their journeys by air to their final destination in Europe.

   Therefore, sea-air cargo flows cater to demand other than that of the concentrated geographic trading area of shipping lines and their ports of call, which become an intermediary port, for sea-air cargo, on their way to final destination. The availability of air cargo capacity at the airports adjacent to the intermediary port is the main reason for the diversion of sea-air cargo.

2. While all port strategy selections by the shipping lines are governed solely by the cargo flow within a trading area, airport selection by the sea-air operator is governed by the availability of air cargo capacities in airports close or adjacent to the high volume ports. What makes air cargo capacities available from/to a certain airport, is largely dependent on considerations other than cargo, and is governed by the policies and strategies of air carriers:

a. Passenger air carriers: The passenger traffic movement, the population of the area and their per capita income, and whether people have the purchasing power to travel by air more frequently, for business or for pleasure, constitute the main considerations for the start of an airline service to that airport. Other factors that are considered as well, are those of: refuelling, technical stops enroute, the ability to offload and re-load passengers (freedoms of the air), etc. All passenger airlines consider passenger traffic as their main source of revenue. Their belly-hold capacity is mainly made available for high revenue, unaccompanied baggage, mail and high value cargo. In the event that some of its capacity remains unutilised, then sea-air cargo is accommodated as 'fill-in' cargo, at reduced cost.

b. Combi air carriers: Airlines operating combi flights endeavour to enhance the low revenue derived from low passenger traffic, by accommodating high revenue cargo that rides on the main deck along with, but segregated from, the passengers.

c. Pure cargo airlines: The pure cargo aircraft is by far the most important factor in the development and growth of the air freight industry. As per the 1994 Boeing Report, total world all cargo aircraft numbered only 1,008 of a total world aircraft of 10,149, i.e. 10%(see Table 7, page 26). Their share of world air cargo movement was 42%, while that of passenger aircraft 51% and that of combis (mixed passenger and cargo), 7% (page 24).

The selection of an optimum airport by pure cargo airlines is largely governed by two main strategies:

1. <u>The Directional Balanced Revenue Strategy</u>:

Considerations to operate an international scheduled, pure freighter service from a carrier's home base to a proposed airport in a foreign country, depends largely on the availability of viable revenue cargoes on both segments of the air journey between the base airport and the selected point. In cases of directional imbalance of cargo traffic, at least one sector's productivity should be sufficient in volume and revenue to absorb the costs of the return to the base sector and result in an acceptable profit margin to the airline in order to sustain the service.

Under the single sector revenue strategy, the airline depends mainly on the revenues derived from the first leg of the return journey as a necessary condition to maintain its service. Air exports from the airline's home base to the country of the selected airport should produce sufficient revenue cargo regardless of its availability on the return leg. Alternatively, the airline may suspend or even cancel its service in cases of:

a. low revenue on both legs of the journey.

b. low revenue on the first leg and volatile, unpredictable revenue on the return leg.
c. a government directive, the imposition of high airport taxes, opposition from people residing in the locality of the airport, curfew hours, etc.

2. <u>The Sea-Air Cargo Revenue Strategy</u>:

The development of sea-air cargo as an offshoot of highly concentrated ocean routes provided the necessary condition for the pure cargo airline to start a regular service, and therefore: the viability and availability of high revenue cargo on at least one sector of the return journey.

The first leg earns low revenue derived from the home base air exports to the sea-air hub. This is compensated by the availability of a continuous and reliable flow of sea-air cargo on the return leg, thus providing the necessary revenue to the airline to sustain its service.

Sea-air cargo has developed from low revenue 'fill in' cargo to relatively high revenue demanded cargo. How did that happen?

The volatility and fragility of available air cargo space, at airports adjacent to high volume hub ports, threw shades of doubt on the reliability of the sea-air concept as a whole. However, the persistence of sea-air operators and freight forwarders, together with the flexibility of shippers and consignees, overcame this hurdle through innovative means, such as overland diversions from the sea-air hub ports of Seattle, Vancouver and Los Angeles to airports deep inland within North America, where air cargo capacities were regularly available. The addition of a few more days of transit time was acceptable to shippers and consignees. Further, sea-air cargo took gradual and periodic tests as to its ability to absorb higher total transport costs:

a. Air cargo capacities that were available for sea-air cargo also became available for other products as well. An example is the products of the newly established readymade garments industry of the U.A.E. (between 1985 and 1995 over 82 readymade garment factories were established). Airline rates were raised from US$ 0.65/kg, applicable to sea-air cargo on the sector DXB - LON, in 1985, to US$ 1.10/kg, in 1994, for the same sector. Sea-air cargo was able to absorb the higher costs of air transport, and survived this hurdle with relative ease, thus providing proof of its continuity and reliability.

b. Sea-air cargo was subjected to further tests: Singapore was started as a sea-air hub in the mid 1980s. As its neighbouring countries of Malaysia, Indonesia and Thailand became more industrialised and productive, this gave rise to quality air export products and as their own air cargo capacities became fully utilised, excess air export volumes were at first 'sea-aired' via Singapore at higher costs than that of direct air from their own airports. Then, due to the continuing pressure of demand, an intermediary air-to-air phenomenon of cargo movement took shape between regional airports of the exporting countries of Malaysia, Indonesia and Thailand to those having available air cargo space to final destinations of the importing regions of Australia, North America and Europe.

Further, the rise of the readymade garment industry in low cost labour countries such as Bangladesh, Sri Lanka and India, has generated surplus cargo searching for air cargo space to final destination through the regional intermediary air-to-air cargo movements. Sea-air cargo had to compete with the 'air-to-air' operations. Because of the relatively high value nature of its commodities, sea-air was able to absorb the higher rate of direct air freight from an intermediary hub airport to its final destination, thus achieving appreciable savings in total transport cost vis-á vis the 'air-to-air' operations at slightly longer transit time.

Example:

Origin to transfer point to final destination	Air to air (cost in US$)	Transit time (days)	Sea-air (cost in US$)	Transit time (days)
JKT/BKK	1.00 / kg	2	0.25 / kg	5
BKK/LON	3.25 / kg	2	3.25 / kg	2
Total	4.25 / kg	4	3.50 / kg	7

The above example shows a sea-air saving of US$ 0.75 per kg at the cost of 3 days longer transit time.

Therefore, in conclusion: Sea-air cargo flow was subjected to many tests in its path of development and reliability. The possibilities for growth are strongly forecast by the freight forwarder, at an average of over 12% per annum[1], and, therefore, is expected to play the role of an "integrator" at the sea-air transfer hub, by taking on the role of providing the means of air transport himself, i.e. the cargo aircraft, thus providing the air capacities required.

With the advent of the new large aircraft, it is forecast that a good number of 15 - 20 year old wide-bodied passenger aircraft will be converted into pure freighters at a reasonable cost. The researcher's findings point out to the emergence, in the next decade, of a new type of 'integrators' - the 'sea-air integrators'.

1. Questionnaires, interviews and direct quotes by Far East sea-air Freight Forwarders of their records, 1984 to 1994, show an average yearly growth of 12.3%. This rate of growth is further confirmed through the computation of world sea-air cargo volume made in this research.

Chapter 9

The Carriers

9.1 Ocean carriers

Sea-air cargo moves almost entirely in containers, from ports of origin to the sea-air transfer hub. There is, still today, a very small percentage of sea-air volume that moves in bulk, from very few ports of the sub-continent of India. This practice is fading away gradually as it is used quite rarely by some shippers to the ports of Dubai and Sharjah due :

1. to the close proximity of these ports to the sub -continent's major gateway ports (5 days sailing time).
2. to dense frequencies of bulk feeder vessel voyages to the ports of the U.A.E. of more than a voyage a day, vs. container vessel feeder frequencies of 2 to 3 voyages per week.

It is of relevance to review adequately, the emergence and development of the cellular container ships and the related problems that accompanied their introduction into the ocean transport industry.

Table 78: Cargo ships and world merchant fleet

% share and growth rate of deadweight & TEU capacity (1989-1994)

Ships of 300grt/gt and over

Ship type	% share of world merchant fleet,(dwt) 1989	1993	1994	Average yearly growth rate % 1989 - 1994* No. of ships	dwt	TEU
A. Cargo Ships						
Container ships (cellular)	3.9	4.8	5.0	4.7	7.4	8.7
Non cellular ships						
General Cargo (single-deck)	3.9	3.9	3.9	0.8	1.8	15.9
General Cargo (multi-deck)	8.4	6.9	6.7	-2.6	-3.2	1.2
Reefer ships	1.1	1.2	1.3	2.8	3.6	13.7
Total	**17.3**	**16.8**	**16.9**			
B. Others						
Oil Tankers	39.8	40.4	40.3	1.9	2.2	NA
Chemical Tankers	1.0	1.1	1.1	5.8	4.8	0.0
Liquid Gas Tankers	1.7	1.9	2.0	3.9	4.8	0.0
Bulk Carriers	30.1	30.4	30.5	0.6	2.1	NA
OBO Carriers	6.2	5.4	5.4	-0.5	-1.4	NA
Total	**78.8**	**79.2**	**79.3**			
C. Others						
Special ships	2.1	2.2	2.1	4.5	3.7	0.9
RoRo cargo ships	1.3	1.3	1.3	5.3	1.7	2.4
Cargo/passenger ships	0.1	0.1	0.1	4.6	-5.4	2.8
RoRo/Passenger ships	0.3	0.4	0.3	3.6	5.6	9.0
Passenger ships	0.1	0.1	0.1	2.6	1.2	0.0
Total	**3.9**	**4.1**	**3.9**			
Total	100%	100%	100%	1.2	1.9	5.7

Source: Institute of Shipping Logistics-Bremen, Shipping Statistics Yearbook-1993. 1993 figures are ISL estimated figures.

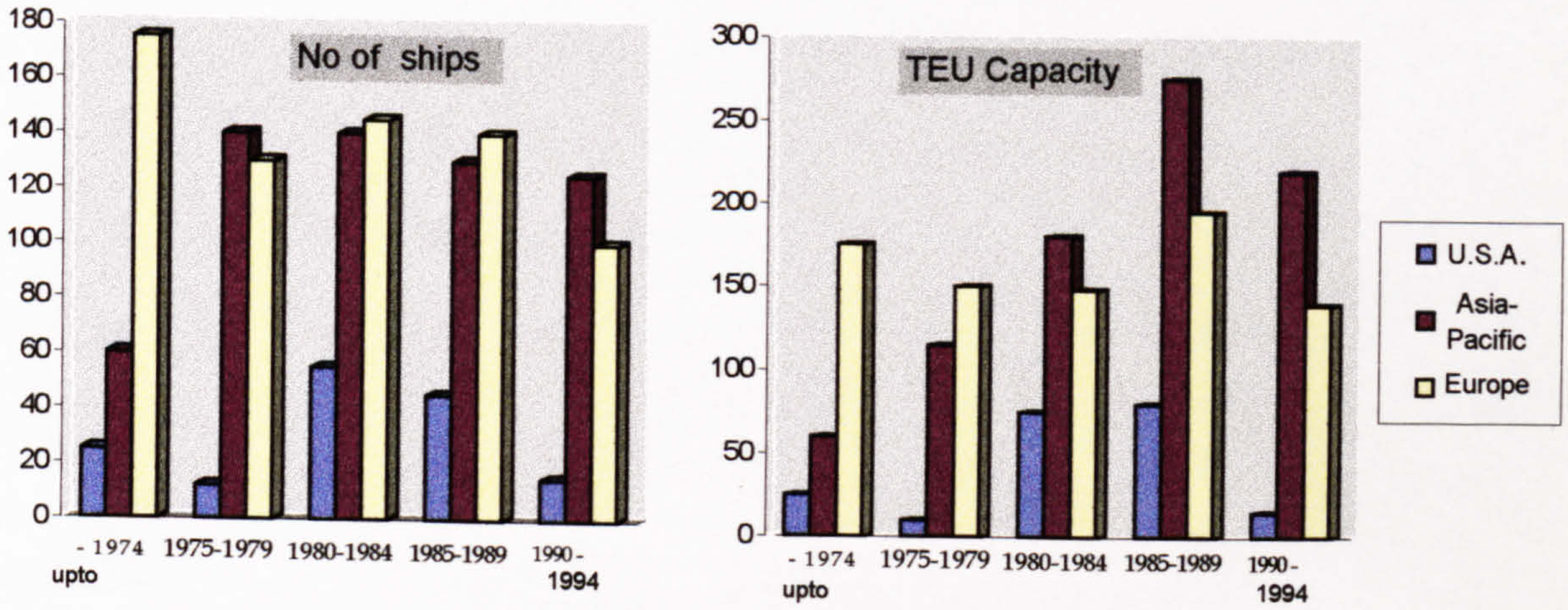
* *1994 figures are forecast, based on the preceding 5 year period average annual growth, 1989 - 1993.*

After the Second World War, and up to the mid 1980's, the shipping industry witnessed revolutionary technological innovations. The introduction of cellular container ships dominated the shipping scene for almost half a century. The western world, comprising mostly Europe and the U.S.A., was the leader in the building of container vessels and in bringing about almost all the technological innovations and developments.

The majority of the world cellular container merchant fleet was built in Europe up to the period ending in 1974. Between 1975 and 1979, Europe's share of the number of container ships built dropped dramatically to approximately 40% of the world total. During the same period, Europe's lost share was almost entirely replaced by the Asian ship builders, specifically Japan and Korea, whose share in the number of ships built, slightly overtook Europe, but at almost 50% less TEU capacity.

During the decade that followed, between 1980 and 1989, Europe's share showed some recovery and became slightly higher than the Asians in the number of container ships built, but at the expense of capacity which was much less than that of the Asians, by approximately 38% (see graph below).

Figure 20 : Existing World Container Fleet by Year And Area of Build



Source: ISL Merchant Fleet data bases of 1993.

This meant a trend reversal of large scale new buildings of all sizes and specially that of the large capacity vessels which became more or less the speciality of the Asian ship-builders. Structural changes in the ship-building industry started to take shape after the mid 1980s when an increasing number of large capacity container ships were built by the Asians and placed in commercial use on major high volume cargo routes.

The largest container ships that entered the world shipping service, in 1993, were BUNGA PELANGI, HYUNDAI ADMIRAL and HYUNDAI

BARON. All three vessels, built by Hyundai Heavy Industries, Ulsan (South Korea), have a capacity of 4,469 TEUs. A further 7 ships of sizes over 4,200 TEUs entered the world service in late 1993 and during 1994.

Ship-building yards of Korea and Japan have continuously and persistently increased their share of this market; by 1993, 43.5% of all world container ships' TEU capacity was built in Japan and Korea. The European's ship-building yards were forced to give way to the fierce competition of the Asians.

This resulted in a massive market shift from the traditional (European) ship-builders to the Asians. New Asian ship-building yards dominated the scene from the mid 1980s onward and up to the present time in 1995, and they are forecast to continue their dramatic growth until the end of this century. Some of the European container ship-builders remained in top world ranks, such as HDW (Howaldts Werke - Dutch - Weft), Vulcan and Odense with the new-comers such as Samsung and Koyo.

A five year period analysis (1987 - 1992) shows the change and shift of large capacity cellular container-ships building to the Asians, as per Table 79, which shows the distribution of shares by country and region at the start and the end of the five years under review, and the current percentage world share of each.

Table 79: Percentage distribution of world cellular shipping *container-ship fleet numbers and TEU capacity by region and country*

	A five year period analysis 1987 - 1992				Current distribution at the beginning of 1993			
Shipbuilder	Number	% share	TEUs (000s)	% share	Number	% share	TEUs (000s)	% share
Asia								
Japan	59	16.8%	169.5	25.0%	217	16.2%	445.4	23.7%
S. Korea	36	10.2%	106.8	15.7%	86	6.4%	237.6	12.7%
Taiwan	22	6.3%	66.6	9.8%	57	4.3%	133.7	7.1%
Total - Asia	**117**	**33.2%**	**342.9**	**50.5%**	**360**	**26.9%**	**816.7**	**43.5%**
Europe								
Denmark	18	5.1%	54.3	8.0%	29	2.2%	86.8	4.6%
France	--	--	--	--	17	1.3%	23.9	1.3%
Germany	48	13.6%	111.8	16.5%	167	2.5%	301.6	16.1%
Total-Europe	**66**	**18.8%**	**166.1**	**24.5%**	**213**	**15.9%**	**412.3**	**22.0%**
Others	169	48.8%	169.7	25.0%	766	57.2%	646.5	34.5%
Grand total	352	100.0%	678.8	100.0%	1339	100.0%	1875.4	100.0%

Source: Computed and tabulated by the researcher from ISL Shipping Statistics, 1993 Yearbook, relevant tables and statistical data.
Others : Include, U.S.A., and other minor ship-builders of the world.

Container Fleet Development

In 1993, the container carrying capacity (cellular and non-cellular) of the world fleet stood at 3.6 million TEU[1]. The

1. ISL Merchant fleet data bases; aggregates based on quarterly updates from Llyod's Register of Shipping/LMIS.

world container carrying fleet had a share of 16.8% measured in tonnage figures (dwt), (see Table 78, page 170, row A. Cargo ships). This share is expected to remain stable at 16.9% to 17% in 1994.

The total TEU capacity, of the cellular and non-cellular ships, grew on average by 5.7% per annum. With an average yearly expansion rate of 8.7%, the cellular fleet had a more dynamic growth than the non-cellular fleet, which had a yearly increase of only 2.8%[1].

The growth of the cellular fleet capacity was marked by structural changes. The statistical results reflect the overall tendency towards larger vessels. The average TEU - capacity of cellular container ships increased from approximately 1,200 TEU in 1989 to 1,400 TEU in 1993. Fully cellular ships entering the container fleet since 1988 concentrated increasingly on TEU capacities of 3,500 TEU and above. A further trend towards larger ships is already in motion, and is likely to continue through the next century in full force.

Looking at the age structure of the fully cellular fleet, it is evident that at least 18% of the older container ships representing 13% of the TEU capacity at the beginning of 1993 is bound to be replaced in the medium term. These ships were mainly built at the beginning of the 1970s; thus they have been trading for more than 20 years. The fully cellular container fleet as of January 1st 1993 had an average age of 11.5 years. ISL broken-up figures for the period under review, show that container ships had been 21 years in service, on average, at the time of demolition.

Trends in container shipping :

A remarkable development took place over a ten year period starting in 1985 and continued until the end of 1994, which showed a very strong concentration of container shipping services to a few shipping operators. As at the end of 1992, approximately 15 container operators were controlling 55% of the TEU capacity for ships ranging in size from a 1000 TEUs and over (ISL Merchant fleet data bases - Shipping Statistics Yearbook 1993). Forecasts by ISL indicate that by the end of 1995, the same 15 container operators will control over 60% of the world's TEU capacities of ships of 1000 TEUs and over.

The leaders of this growing trend of TEU capacity concentration, with their relevant percentage share of world TEU capacity of ships size 1000 TEUs and over, at the end of 1992, are :

1. Maersk Lines - 7.2%
2. Evergreen - 7.2%
3. SeaLand - 6.7%

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1. ISL Merchant fleet data bases; aggregates based on quarterly updates from Llyod's Register of Shipping/LMIS.

Table 80 shows how the fleet patterns differ from one operator to the other, in terms of ship sizes, TEU capacities and age.

Table 80. Fifteen top ranking
container shipping operators as of Jan 1st 1993

Ships of 300grt/gt & over

Operator	No.	1000DWT	1000TEU	Av Age	Av 1000DWT	Av 1000TEU
European/US						
MAERSK	44	1917.7	114.4	7.7	43.6	2.6
SEA-LAND	41	1436.3	107.3	11.64	35.0	2.6
APL *American President Line*	21	848.9	58.4	11.76	40.4	2.8
P & OCL *P & O Container Ltd.*	22	944.3	58.1	14.73	42.9	2.6
HAPAG-LLOYD	21	932.1	57.0	10.63	44.4	2.7
OOCL *Orient Overseas Container Line*	20	768.5	51.2	11.5	38.4	2.6
NEDLLOYD	23	842.5	50.9	10.03	36.6	2.2
FAR EASTERN						
EVERGREEN	46	1837.7	114.1	9.35	39.9	2.5
NYK *Nippon Yusen Kaisah*	35	1338.1	83.3	8.86	38.2	2.4
MOL *Mitsui OSK Lines*	28	1073.2	62.8	9.14	38.3	2.2
HANJIN	24	928.9	56.9	6.92	38.7	2.4
YANGMING	21	777.1	56.8	8.14	37.0	2.7
K - LINE *Kawasaki Kisen Kaisha*	21	799.0	48.8	6.73	38.0	2.3
NOL *Neptune Orient Lines*	15	590.9	37.8	11.04	39.4	2.5
Middle East						
ZIM *Zim Israel Navigation Co. Ltd.*	24	802.3	41.8	12.84	33.4	1.7
Total	406	15837.5	999.7		39.0	2.5

Source: ISL Merchant fleet data bases; aggregates based on quarterly updates from Lloyd's Register of Shipping/LMIS and Containership data from MDS Transmodal.

This concentration of large size container ships to a few operators resulted in fierce competition among themselves, bringing freight rates to very low levels. The high costs of building new container vessels, together with the high cost of operating them, and the lower revenues derived from lower freight rates, have forced the shipping lines to search for new ideas in order not only to survive, but to operate at a profit without having to reduce their orders for new ship-building contracts.

Despite the high cost of ship-building (see Table 82, page 176), the long term container market prospects continue to grow positively as the number of new ship-building contracts between 1987 and 1992 grew by an average of 11.5% per annum, as per the quarterly updates from Lloyds Register of Shipping, March 1993. Further, ISL registered 127 ship-building contracts for container vessels, equal to 3.2 million dwt in, 1992 with slightly higher dwt contracts in 1993.

The container shipping operators main objective was to reduce their costs of operations. The first step was to change their national flag registration to a flag of convenience, with lower taxes. Shipping lines of the western world were subjected to heavy taxes of registration and licensing of their ships, and were not permitted to employ foreign or imported cheap labour or crew. There were exceptions, such as with the British unions, who allowed the use of Indian labour. Many western ship owners have used flags of convenience with no restrictions on labour.

In 1980, the combined merchant fleet of Europe had a freight capacity of approximately 247 million deadweight tonnes. In 1987 this fleet lost more than 37% of its European registered capacity to the countries with Open Registry[1] (Flags of convenience). Thus flags of convenience capacity registrations increased by almost the same capacities lost by Europe. Some of the most impressive registrations of container fleet capacities measured in percentage share of the world total, were as follows in 1988 (ISL Shipping Statistics 1993).

Panama	11.0%	Flags of convenience
Liberia	8.3%	
USA	10.2%	For comparison purposes
Germany	9.2%	
Taiwan	8.5%	

However, developments over the five year period between 1989 and 1993 show that the flags of convenience registrations increased considerably at the expense of the traditional flags of the OECD[2] (Organisation for Economic Co-operation and Development) and EEC[3] countries (European Economic Community).

In 1993, OECD flag registration had a share of 42.2% of the total, as compared with 47.1% in 1989, while the open registry share of total TEU capacity rose from 21.4% in 1989 to 24.0% in 1993. The average yearly growth rate of the Open Registry countries is shown in Table 81, at 8.8% and 11.8%, as compared with OECD countries at 1.3% and 5.7%, for the number of ships and TEU capacity respectively.

Table 81. **Open Registry development (flags of convenience)** *in relation to world registry*

Ships of 300grt/gt & over

Year	OECD Registry		Open Registry		Others		Total	
	No.	1000TEU	No.	100TEU	No.	1000 TEU	No. of ships	1000TEU
1989	429	633.3	248	288.2	436	422.4	1113	1343.9
1990	412	644.2	257	310.2	478	480.2	1147	1434.5
1991	453	718.6	268	325.6	468	513.1	1189	1557.2
1992	463	767.3	306	394.7	504	571.9	1273	1733.9
1993	451	791	347	450.2	541	634.2	1339	1875.4
	Average annual growth rate 1989 to 1993							
	1.3	5.7	8.8	11.8	5.5	10.7	4.7	8.7

Source: ISL Merchant fleet data bases; aggregates based on quarterly updates from Lloyd's Register of Shipping/LMIS.

1. Major Open Registries: Countries permitting the registration of ships owned by non-residents. Open registries listed by ISL include open registry flags Bahamas, Bermuda, Cyprus, Liberia, Panama only.
2. OECD Countries: Australia, Austria, Belgium, Canada, Denmark (Danish International Ship Register), Denmark (Ordinary Register), Finland, France, Germany, Greece, Iceland, Italy, Ireland, Japan, Luxembourg, Netherlands, New Zealand, Norway (Ordinary Register), Norway (Norway International Ship Register), Portugal, Spain, Sweden, Switzerland, Turkey, UK and US.
3. EEC Countries: Belgium, Denmark (Danish International Ship Register), Denmark (Ordinary Register), France, Germany, Greece, Italy, Ireland, Luxembourg, Netherlands, Portugal, Spain, and UK.

The second measure by ship owners was to decrease the cost per slot (a purchase of a small portion of space on board a container ship), offered to their customers. To decrease the cost per slot meant that a great many slots were needed to be made available on ships. This was achieved at a very high cost of investment in building large size vessels. ISL Shipping Statistics Yearbook 1993 quotes average contracting prices for new buildings for the period between 1988 and 1992 as tabulated in Table 82, below.

Table 82: **Ship-building contracts costs**
(millions of US$)

Ship size	New building prices in millions of US$				
Dwt/cbm	1988	1989	1990	1991	1992
30,000	27.0	31.0	30.0	30.5	27.0
80,000	38.0	43.0	44.0	44.5	40.0
130,000	46.0	54.0	55.0	55.5	49.5
250,000	73.0	82.0	86.0	90.0	85.0
400,000	88.0	101.0	120.0	125.0	119.0

Source : Farnley's, review 1992, Oslo, January 1993. Prices based on Japanese and Korean shipyards.

Up to 1985, container ships were built up to a maximum capacity of 3000 TEUs (Twenty Foot Equivalent Unit - Container). In early 1986, US lines produced the first jumbo container ship with a capacity of 4,470 TEU's.

The trend of employing economies of scale through the building of larger container vessels took momentum. Many shipping lines started ordering super large cellular container ships. American President Lines' order, in 1986, of Panamax plus container ships, showed that the trend was to continue growing. In 1984 cellular container vessels which were 15.7% of the total world container vessels grew to 21.5% in 1985, and by the end of 1989, the cellular ships share grew to 22.5%. By the end of 1993 it assumed approximately 28.6% of total container vessels and in 1994, the share of fully cellular container vessels is forecasted to stabilise at 30% (see Table 78, page 170).

In terms of capacities, orders for super large container vessels can best demonstrate this trend through a statistical review of world ship-building yards' productions by vessel size. The Koya ship-building yard of Japan had its total ship-building production concentrated on two major sizes. 50% on over 3500 TEUs capacity ships and 50% on 1000 - 3499 TEUs capacity ships. Daewoo of South Korea, on the other hand, had 48% of its production on ships of over 3500 TEUs capacity and 52% on 1000 - 3499 TEUs capacity ships.

Table 83, below, shows almost 5% of total world ship-building was focused on over 3500 TEUs capacity ships, with 51% of world cellular container ships produced with a capacity ranging from 1000 - 3499 TEUs and nearly 44% of below 1000 TEUs.

Table 83. World major ship-building yards
percentage distribution of ship sizes built between 1986 and 1993

Ship-builder	size groups (in TEU) as % share of total no. of ships			Largest vessel built (TEUs)
	- 999	1000 - 3499	>=3500	
Japan				
Ishikawajima	4.3	69.6	26.1	4038
Mitsubishi	24.0	72.0	4.0	3568
Mitsui	15.0	75.0	10.0	4000
Tsuneishi	37.0	63.0	-	2875
Kawasaki	-	100.0	-	3456
Onomichi Line	-	100.0	-	3428
Imabari	44.4	38.9	16.7	3502
Hitachi	17.6	82.4	-	2832
Koyo	-	50.0	50.0	3800
South Korea				
Hyundai	2.4	90.5	7.1	4469
Daewoo	-	52.0	48.0	4258
Samsung	-	68.4	31.6	4422
Germany				
Howaldt	15.8	78.9	5.3	4340
Vulkan	3.9	92.2	3.9	4340
Flender	16.7	83.3	-	2594
Warnow	50.0	50.0	-	1254
Blohm	15.4	84.6	-	3010
Taiwan				
China SB	12.3	82.5	5.3	3604
Denmark				
Odense	-	58.6	41.4	3922
France				
Alsthom	47.1	52.9	-	2536
Others	65.5	34.2	0.3	
Total	43.8	51.3	4.9	

Source: *ISL Merchant fleet data bases; aggregates based on quarterly updates from Lloyd's Register of Shipping/LMIS.*

The third measure may have taken some shipping lines by surprise, as it came from a government body and was forced upon the shipping line industry in a way that boosted competition, thus lowering the ocean transport costs offered to the public, and not necessarily reducing the cost of shipping line operations. This measure came through the historic development that took place in the U.S.A. on 18 January, 1984. A completely new shipping law was passed. The US Shipping Act of 1984 altered fundamentally all regulations and procedures that had prevailed since the shipping act of 1916. The Act of 1984 gave, among other things, shipping conferences[1], and all other shipping lines calling at US

1. Conferences : A number of shipping lines joined in an agreement on a certain ocean route to apply a fixed freight rate for a variety of classified goods covering ocean transport from port to ports.

ports, the right to publish intermodal rates, i.e a single rate covering all sectors of transportation from origin to destination. These intermodal rates must be reviewed by the Federal Maritime Commission (FMC) within 45 days from the date of filing. In the case of a no objection by the FMC, the rates become effective. If the FMC considers the rates to be monopolistic and, therefore, anti-competitive, then it will get a court-ordered injunction to block these rates.

This clearly meant a boost to the development of intermodal transport. The Act was one of de-regulation in favour of free competition, letting the market forces of supply and demand determine the level of services and costs.

The new law allowed shipping lines to :

1. Select whatever ports of call to the US, they wish to use.
2. Select the gateway from which the shipping lines wish to assume inland transport of their containers.

Free competition, free entry to the market and the uplifting of the world port's traditional restrictions blew wide open the doors for all shipping lines including international ones to join in the competition of door deliveries to consignees.

The conference system traditionally offered a single fixed freight rate covering the ocean sector from port to port. Conferences were reluctant to allow their members to cover the inland sector of the intermodal movement of a shipment beyond the port of call. Many individual[1] shipping lines did, in fact, stretch their activities to cover the inland movement of cargo. Shipping lines' conferences became an immediate target for the new comers, the intermodal operators, who were prepared to undercut the freight rates agreed by the liner conferences.

Competition became fierce on shipping routes of international trade, and conferences were subjected to increasing pressure by the outsiders. Many conferences were not able to hold a different rate level and had to give in to the market rates.

Conferences found it increasingly difficult to survive as their share of the global market was dwindling quickly. The biggest challenge to conferences was, and still is, the continuing growth of intermodality. Arguments, at various government levels, became open as to whether the conference system would survive the changes in the transportation system, which offered the public a door to door service, single rate and one 'Combined Transport Document', with a defined liability.

The US shipping lines had to face the challenge of 'door to door' competition that was knocking heavily at their doors, and breaking deep into the country's transport system. The US shipping lines responded immediately by co-operating with the already de-regulated railways.

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1. individual: independent operators outside conference lines.

American President Lines (APL), Sealand and US lines[1] started to control their Far East traffic by designing special rail cars to accommodate double stacks, and by using special and dedicated unit trains (dedicated trains are for the exclusive use of one shipping line). In brief, each shipping line established its own rail route from the ports of entry and gateways of Seattle, Los Angeles and San Francisco to Chicago, New York the mid west and the southern parts of U.S.A.

The future potential of intermodality was foreseen by all the players in the transport system, although the shipping lines were the first to realise the future potential and were responsible for the innovations that came about in mainly the 'door to door' concept of the total distribution system. Such innovations centred partly on the possibilities of an acquiring a railway or a trucking system by the major shipping lines, and the formation of giant enterprises.

Other modes of transport took the initiative in the opposite direction. Such was the attempt to take over Sealand in the late 1980s by a US east coast railway giant. Sealand's early start was a trucking firm, it later moved into containerisation and became one of the largest container ship operators in the world. The mere attempt by a railway to acquire a container shipping line represents an unusual trend in the transport system, that may give rise to the formation of huge intermodal transport entities, which will be able to offer shippers and consignees a total distribution network operated by a single entity, a single rate and a combined transport document covering transport ex works to door, at a defined liability.

The formation of giant intermodal enterprises constitutes a direct danger to competition and the smaller operators. To face the probable challenges of mergers and the consequential effects of a giant multimodal entity, smaller and individual shipping lines started a trend of co-operation among themselves. The question was: *How to maintain their clientele in the face of such emerging giant intermodal entities that are able to offer lower rates among a variety of related services?*

To operate large container vessels with a capacity of over 2500 TEUs on a high volume route is good in theory. In practice, the frequency of service to and from a certain port is the service that retains a customer. At the same time, to maintain a high load factor on large container vessels is vital for survival in covering high operational costs. Despite these difficulties, the trend took form, and a move by individual shipping lines to limit the number of ports at each side of the ocean was made in the mid 1980s, and regular frequencies of large container ships were established to a limited number of ports.

The move resulted in ;

a) concentration of a huge number of containers at these ports

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1. US Lines disappeared in the late 1980s and declared bankruptcy. Application of chapter 11 didn't help.

for further distribution inland by overland transporters, and

b) the emergence of intermodal sea-air transfer hubs.

A high load factor on these large container ships was essential for the profitability of the system. To achieve a high load factor, shipping lines collaborated among themselves in various ways. Shipping lines entered into agreements with each other on slot chartering and many other aspects such as joint fleets, pools etc. Such were the agreements concluded on US trade routes between Japan Lines and Evergreen and between OOCL, NOL and K - Lines. The common objective of this collaboration between shipping lines, was in the first place to maintain a regular frequency to a limited number of ports on both sides of the ocean. The second was the satisfaction of their clientele, who provide high volume cargoes and, therefore, the required high load factor for survival, profitability and continuity.

The third objective, and the most important, as far as this field of research is concerned, was the build-up of intermodal sea-air cargo on these routes, generating a relatively higher returns for the shipping lines who became increasingly involved in attracting this particular traffic.

The question is : How does sea-air cargo generate a relatively higher return for the shipping lines?

Sea-air cargo is largely cargo that was attracted from the all ocean mode in the first place. For example, the sea-air route via the U.A.E. has attracted ocean cargo that was bound for Europe on direct all ocean routes from the Asia-Pacific region ports to the main gateway ports of Europe. The part of all ocean cargo that was diverted to the sea-air mode, added volume and, therefore, support to the high volume, high frequency short routes from the same ports of the Asia-Pacific region to the intermediary hub ports of the U.A.E.

This means added revenue to the shipping lines serving high frequency, short transit time routes, and at the same time, represents a marginal loss to shipping lines serving direct all-ocean, long transit time routes, unless these same lines serve the intermediary ports of the U.A.E., enroute to Europe. As such, no losses are incurred.

In the first case, the sea-air cargo volumes gained by the shipping lines, operating the high volume, short routes, such as the Asia-Pacific/U.A.E., represent approximately 40,000 tonnes a year on average today (this figure was obtained from statistics and forecasts of sea-air volumes via the U.A.E., analysed in Chapter 6, section 6.3), with an average load of 4 to 4.5 tonnes per 20 ft container. This means that approximately 10,000 TEUs per year, at an average yield of US$ 1,325.00 per TEU, or a total of US$ 1,325.00 x 10,000 TEUs = US$ 13,250,000.00, in added revenue to the shipping lines serving this sea-air route.

In the second case, where no losses are incurred due to the assumption that the same shipping lines are serving both the sea-air transfer ports and the direct all ocean ports, the additional revenue materialises as the shipping lines charge additional fees to sea-air containers as they are handled on a priority basis, i.e loaded last at the port of origin, and off-loaded first at the sea-air transfer hub port, thus saving on transit time. The additional charges are shown in Table 84, below.

Table 84: Shipping lines' sea-air rates
as compared with standard cargo rates & transit time per 20 ft container in US $

From Asia-Pacific ports to U.A.E. ports*	Sea-air rate	Transit time	Other cargo rates
From Taipei			
Maersk	1,500.00	17 days	1,400.00
APL	1,350.00	13 days	1,275.00
Sea-Land/NYK	1,200.00	17 days	1,275.00
Hanjin	1,050.00	24 days	1,000.00
K Line	1,200.00	17 days	1,125.00
From Hong Kong			
APL	1,375.00	12 days	1,200.00
Maersk	1,400.00	17 days	1,300.00
Senator	1,250.00	19 days	1,150.00
From Jakarta			
NYK	1,350.00	19 days	1,275.00
Maersk	1,400.00	19 days	1,350.00
APL	1,350.00	16 days	1,275.00
From Bangkok			
NYK	1,400.00	18 days	1,300.00
Maersk	1,500.00	18 days	1,400.00
APL	1.350.00	14 days	1,275.00

Source: Faxed quotations from Far East based freight forwarders and shipping lines.

Note: All transit times exceed 13 days which means that frequency to the U.A.E. is scheduled via an intermediary port enroute; most shipping lines have feeder services to Singapore, from where they operate direct to the U.A.E. ports.

** : U.A.E. ports include Port Jebel Ali & Rashid in Dubai, and Fujairah Port.*

On average, the additional charge is approximately US$ 75.00 per TEU. This means an additional revenue of 10,000 TEUs x US$ 75.00, which equals US$ 750,000.00 (three quarters of a million US Dollars in additional charges). These additional revenues must be looked upon globally, as only few shipping lines are harvesting the benefits of sea-air cargo, such as APL, Maersk, OOCL, Mitsui and K Lines.

Globally an average of 100,000 TEUs of sea-air cargo is handled by five major shipping lines, yielding additional revenues of US$ 7.5 million, per year, for a practically cost-less service of loading last at origin and off-loading first at a sea-air hub.

Though the additional benefits of sea-air volume may not be substantial to the shipping line, they are certainly substantial for the airlines uplifting this cargo from a sea-air transfer hub. The findings of this research show approximately 400,000 tonnes of all ocean freight are diverted globally to the sea-air mode every year. As air freight is charged on the basis of a kilogramme, the converted sea-air volume represents 400 million kilograms which is sold presently by the airlines at an average rate of US$ 1.25/kg (see Chapter 5, section 5.3 and Chapter 7, section 7.1), which means an additional revenue of half a billion US dollars (US$ 1.25 x 400 million kgs) to the airlines operating from the sea-air transfer hubs of the world.

In a 'Sea-air Seminar', held on Oct 25, 1993, in Sharjah, U.A.E., APL involvement in intermodality was manifested in detail. The following are excerpts from the APL presentation.

"American President Lines introduced containerised cargoes to the Middle East in the early 1970s and plans to augment services to the region, which it now serves via the Indian and Pacific oceans.

Every Friday, an APL vessel carrying up to 2,400 containers from the U.S.A. and South East Asia, calls in at Fujairah on the U.A.E. east coast. Serving this same hub, four feeder services extend to and from 14 port locations in the Middle East and the subcontinent. These feeder services cover India, Pakistan, all the Arab Gulf states (Qatar, Kuwait, Saudi Arabia, Bahrain and Oman), and the Red Sea port of Jeddah (Saudi Arabia) and Aqaba Port of Jordan.

Such transportation involves movement by land and ocean under a single bill of lading issued by APL. As such APL operates as an intermodal transport company, controlling shipments on board vessel, truck and dedicated rail services.

The APL transportation network also includes extensive port and warehousing facilities. In the U.A.E. for example, APL's container terminal in Fujairah holds up to 5,000 TEUs stacked in a computerised inventory linked to APL's worldwide on-line information network. Sea-air and other shipments, with a destination within the U.A.E., are either delivered by vessel to Dubai ports or transported through an exclusive trucker direct to the consignee, or trucked from Fujairah Port to APL's inland terminal in Dubai.

For Less than Container Loads (LCL), APL, through its agents in Dubai, offers an extensive bonded warehouse inside Dubai Port. This facility is also linked to the APL network for smooth cargo tracking in anticipation of customers' requirements. This network is supported by more that 100,000 containers, the largest number held by any company in the region.[1]"

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1. From a presentation by John D. Bowe, Managing Director of APL - Middle East Region at a conference 'Sea-air through partnership', held in Sharjah, 25 Oct 1993.

Further, "on the question of freight rates, APL studies the entire cost of transporting boxes from origin to destination. Involved will be movement by truck, train and ship and back to truck, until a final delivery is made at an inland terminal, consignee warehouse or air transit facility".

One of the cost saving advantages which APL offers, is the 45 ft container, which holds 12% more cargo than the 40 ft container. Overland transportation costs for these boxes are the same as for the conventional ones. Thus the consignee obtains additional value at the same cost.

APL, operating as an independent large size intermodal company, has achieved most of their objectives of maintaining their customers, and, therefore, have a high load factor for the ocean leg of the sea journey, in addition to overland door deliveries at decreased costs to their clients.

The medium to small size shipping lines had to face the challenges of a giant intermodal entity such as APL, for their survival. They started by rationalising their service policy. They did so by first horizontal and later by vertical integration. Horizontal integration was manifested by the emergence of many joint agreements between small and medium size shipping lines who pooled their resources in order to provide the necessary capital needed to acquire new ships.

Consortia and joint service agreements became common in Europe, especially in the mid 1980s, and, therefore, the ability of small and medium size shipping lines to compete with the giants was enhanced, thus depressing further, the level of freight rates. Lower freight rates meant lower profitability, which caused the shipping lines to again rationalise. A new vertical trend of co-operation was developed, that of feeder services to a giant's hubs.

In other words, co-operation between the small shipping lines, not only among themselves, but also with a giant intermodal enterprise, took form in the feeder services, which mushroomed around sea-air hubs such as the U.A.E. ports of Fujairah and Dubai, Singapore and Hong Kong on the eastern route, and Vancouver, Seattle/Tacoma, Portland and the ports of Southern California such as San Francisco, Oakland, Long Beach and Los Angeles on the western route.

Similar developments took place in Europe. The growth of international trade between the Far East and Europe, and between Europe and the Americas, resulted in two directional traffic on both routes. Firstly the route between Europe and the east coast of the Americas, and secondly between the Pacific basin countries of the Far East and Europe.

High volume-high return route groups emerged at the main ports of entry to Europe which were also opened to international shipping lines of the Far East and the Americas. The main ports of entry were Rotterdam, Antwerp, London, Hamburg, the Bremen ports, Algeciras, Marseille, Piraeus and Genoa.

These feeders, or complementary services, each had a relative advantage to its operator, by maintaining its customers and profitability. Maintaining customers was high on the agenda of all operators of various modes of transport. Customers' demands focused on the 'door to door' service, and not on selection of a certain carrier and a certain route. A package was offered to the shippers covering all modes of transport (except sea-air which was and still is the exclusive domain of the freight forwarders) and up to the consignee's door, at a single rate, in an effort to gain control of cargo movement.

In conclusion :

The emergence of sea-air hubs and the consequential growth of sea-air cargo movements can be termed as an offshoot result of the shipping lines' continuous drive to improve ocean-overland intermodal development, over a decade of hard work after the deregulation act of 1984. The trend increased the use of containerisation and the development of large container vessels of over 2500 TEUs that dominated the shipping scene since the mid 1980s, and up to the present time.

To maintain high load factors on these large container vessels was essential to the profitability of the system. A move to limit the number of ports at each side of the ocean of any two major industrial centres was made, and high volume routes were established with dense frequencies.

Smaller shipping lines had no choice but to support high volume routes with feeder services. As a result, 'hubs' or re-distribution centres, employing various modes of transport, emerged. The sea-air operators and freight forwarders took full advantage of this development and successfully introduced the sea-air mode, while ocean-overland intermodality became out of their reach as it was developed heavily by the shipping lines and Airport Authorities at both ends of a high-volume, high-return route. Ocean overland cargo volumes are, by far, greater than those of sea-air, with the ocean lines practising a firm grip over this cargo flow in order to retain their clientele.

9.2 Air carriers

A basic requirement for the emergence and development of a sea-air transfer hub, is that air carriers should be able to offer huge unutilised air cargo capacities, and should be willing to accommodate increasing volumes of sea-air cargo on their dense frequencies. The air-freight industry took a giant stride during the mid 1970s when cargo, in massive magnitudes, was uplifted from one point to another. The B 747 long range wide-bodied aircraft was largely responsible for this development. This meant increased aircraft productivity with the ability of large sized aircraft to carry larger loads of cargo at higher speeds providing lower cost per unit of cargo weight and volume.

However, it must be stressed that in 1994, almost all international flight services by major airlines connecting the main gateway airports of the world's six regions are operated by wide-bodied aircraft, with very few exceptions. A good example is provided by the airports of today's active world sea-air hubs. All international scheduled flight services from/to the sea-air hub airports of Vancouver, Seattle, Los Angeles, San Francisco and Singapore use exclusively wide-bodied aircraft.

However, from/to Miami International Airport, international scheduled flights and South and Central America are still using the B727, DC 8, B707 and B757 narrow bodied aircraft operated by pure freight carriers.

Exactly the same types of narrow bodied freighters are employed between U.A.E. and Europe's airports, while narrow-bodied passenger aircraft are not scheduled from/to any of the sea-air hub airports mentioned above.

Air cargo capacity available on these aircraft is as follows:

1. Passenger wide-bodied aircraft have a volumetric underdeck cargo capacity of 60 cubic metres; depending on the density of the cargo consignments, loads from 10 to 34 tonnes (Boeing B747-400, March 1995 release) can be accommodated along with full passenger occupancy.

   The second type of aircraft, in terms of carrying capacity, is the DC10, all series, first introduced in 1971, followed by the L1011 Tristar in 1972. The DC10 is also a long range wide-bodied aircraft with the underdeck cargo compartments having a capacity of approximately 60 cbm. It is able to carry loads starting from 10 to 24 tonnes, depending on cargo density; while the Tristar L1011 has 35 cubic metres and the L1011-50 has 50 cubic metres cargo capacity in their respective belly-holds.

   The DC8 passenger aircraft has the largest underdeck capacity of 48 cbm, followed by the B737-300 and 400 series, with cargo space of 35 cbm, and lastly the B707 and B727 with cargo space of 18 cbm each. It should be noted that these aircraft were operated not only on medium and short ranges, but also on long ranges where fuel priorities took precedence to cargo loads on take-offs. Further, the B737 all series was mostly used as an inter-city jet for commuter services, especially in Europe, and was hardly able to carry any cargo in its belly-hold due to the fast turnround, required by this type of service, at airports.

The cargo capacities of the narrow-bodied passenger aircraft are on average equal to almost half that of the wide-bodied. In practice, passenger baggage occupied almost half the belly-hold space, leaving 9 to 12 cubic metres for cargo in the B707 and B727 aircraft, while the B737 was left with 20 to 25 cubic metres for cargo, which in fact was rarely used because of its specialised short range - fast turnround commuter services.

2. Pure cargo freighters : The real revolution in the air-freight industry started with the entry into the market of the B747 all-freighter services. This aircraft was able to accommodate 100 deadweight tonnes of freight, with a volumetric capacity of 600 cubic metres, while the narrow bodied freighters had the following capabilities :

B707	40 deadweight tonnes and 170 cbm
B727	15 deadweight tonnes and 90 cbm
DC 8	40 deadweight tonnes and 185 cbm
B737-200	18 deadweight tonnes and 95 cbm
B757	38 deadweight tonnes and 170 cbm

The wide-bodied MD11 was able to carry 30 tonnes of freight at 185 cubic metres volumetric capacity and the DC10, 60 tonnes of freight with 360 cubic metres of space. The difference between the two types of aircraft was in the ability of the wide-bodied aircraft to accommodate large sizes of consignments ranging between 365 cbm (DC 10) - 600 (B747) cubic metres of volumetric cargo.

3. Combis: A combination of passenger and cargo aircraft, whereby part of the main deck is segregated by way of a partition for cargo loading, in the form of pallets, containers or mounted on skids, thus availing a weight capacity of 15 tonnes for the MD11, 20 tonnes for the DC10 and 30 tonnes for the B747, and the same volumetric capacity of 60 cubic metres for all types in addition to their underdeck cargo compartments.

Wide-bodied B747 combis are able to accommodate 5 times the narrow bodied B727 and B737 combis and 2½ times the DC 8 combi. The MD11 and DC10 combis are able to accommodate almost double the deadweight tonnage of the DC8 combi.

The real advantage lies in the huge volumetric space that became available with the advent of the wide-bodied aircraft. This advantage is properly realised in the airline revenue derived from the carriage of air cargo;

chargeable volume weight set at 6 cubic metres to equal 1 tonne or 1000 kilograms of deadweight, this means that low dense consignments (high volume -low weight) are charged according to the 6 : 1 rule; 6 cubic metres = 1 tonne, or 1 cubic metre = 166.6 kilograms. If a consignment measurement length, width, height gives a cubic volume of one metre and weighs less that 166.6 kilograms, then 166.6 is charged regardless of actual weight. If the consignment weight is 200 kgs, then cargo becomes high dense, and 200 kgs is charged. The rule is to charge a ratio of 6 : 1, whichever is greater.

Table 85: Freight load factors
of world sea-air transfer hubs
total air export cargo capacity utilisation to Europe
inclusive of sea-air traffic, 1994

Sea-air transfer hub	Available - usable air cargo capacity, in tonnes (for exports)	Air freight uplifted, in tonnes (excluding sea-air)	Freight Load Factor (excluding sea-air)	Air freight uplifted, in tonnes (including sea-air)	Freight Load Factor (including sea-air)
Vancouver	29,500	14,800	50%	24,000	81%
Seattle	27,300	8,100	30%	21,100	77%
Los Angeles	186,300	80,800	43%	131,000	70%
San Francisco	149,200	93,200	62%	120,200	81%
Miami	86,600	63,000[1]	73%	63,000	73%
Singapore	178,400	141,800[2]	79%	146,800	82%
Dubai	80,800	54,200	67%	60,200	75%
Sharjah	66,800	39,300	59%	55,400	83%
Abu Dhabi	26,000	18,400	71%	22,200	85%
U.A.E. Total	173,600	111,900	64%	137,800	79%

Source: *Computed and tabulated from figures derived in the sections on sea-air transfer hubs, Chapters 5 and 6.*

Having determined air cargo capacities available on the services of wide-bodied aircraft of all types, passengers, combis and pure freighters in addition to pure freighter narrow-bodied aircraft, freight load factors can be precisely figured therefore, to show the exact utilised cargo capacities on scheduled international flight services from a particular airport. If all the requirements of the sea-air mode were provided, an introduction of sea-air traffic is able to substantially decrease, the unutilised capacities available on the international airline scheduled services from that airport.

Table 85, above and Table 86 on page 188, show the freight load factors at the world's most successful sea-air transfer hubs airports, before and after the application of the sea-air volume to the international air export traffic, thus showing the exact contribution of sea-air traffic in decreasing the volume of unutilised capacities that were available.

Table 86: Freight load factors
of world sea-air transfer hubs
total air export cargo capacity utilisation to South/Central America, inclusive of sea-air traffic, 1994

Sea-air transfer hub	Available - usable air cargo capacity, in tonnes (for exports)	Air freight uplifted, in tonnes (excluding sea-air)	Freight Load Factor (excluding sea-air)	Air freight uplifted, in tonnes (including sea-air)	Freight Load Factor (including sea-air)
Los Angeles	85,400	13,300	16%	63,400	74%
San Francisco	9,800	1,700	17%	1,700	17%
Miami	588,400	243,000	41%	524,000	89%

Source: *Computed and tabulated from figures derived in the sections on sea-air transfer hubs, Chapters 5 and 6.*

Current load factors, as computed in Tables 85 and 86, from all active world sea-air transfer hubs to Europe and to Central and South America, all show a high percentage, with the exception of San Francisco, to South & Central America, where the load factor is 17% due mainly to the fact that almost all international services to this region are operated by U.S. carriers who re-currently confirmed their lack of interest in carrying sea-air traffic. All other load factors ranged from 70% (Los Angeles) to 89% (Miami). This means that growth in sea-air volumes is limited to a few percentage points.

1. Sea-air traffic arrivals into sea-air transfer hubs are largely concentrated on the weekends, and some mid-week scheduled international services are bound to miss this 'fill in' cargo flow.
2. General cargo traffic is accepted for carriage in various shapes and sizes, and, therefore, some space is bound to be lost in building this traffic in standardised unit load devices such as, air pallets and air cargo containers.

For all practical purposes, 90% freight load factor could be considered as the maximum attainable under actual market conditions. Therefore, prospects for a dramatic sea-air traffic growth is subject to many factors, such as:

1. An increase in passenger scheduled international wide-bodied flight frequencies to major gateway airports of Europe, South & Central America.
2. An increase in combi wide-bodied flight frequencies.
3. An increase in pure freighter frequencies and the entry of newcomers, freighter operators (airlines) to the sea-air cargo industry at sea-air hubs.
4. Overland diversion to airports where cargo capacities are available.

The present weekly frequencies of wide-bodied international scheduled flights (Passengers/combis/freighters), in addition to narrow bodied freighter services, are shown in Table 87, on the following page.

Table 87. Weekly frequencies of wide-bodied aircraft
(Passenger/combis/freighters & narrow bodied freighters)
between world active sea-air hubs
and Europe's main gateway airports

European Gateways	Vancouver	Seattle	Los Angeles	SFO	Miami	Singapore	U.A.E.
London							
Passengers	P - 19	P - 12	P - 43	P - 44	P - 33	P - 23	P - 55
Combis	C - 4						C - 1
Freighters					F - 1	F - 2	F - 6
Amsterdam							
Passengers	P - 3	P - 3	P - 23	P - 11	P - 4	P - 13	P - 23
Combis			C - 4	C - 3		C - 5	C - 1
Freighters		F - 1			F - 1	F - 3	F - 7
Brussels							
Passengers					P - 7	P - 2	
Combis							C - 2
Freighters						F - 4	F - 16
Paris							
Passengers	P - 2		P - 27	P - 18	P - 19	P - 4	P - 12
Combis			C - 7	C - 4		C - 3	C - 1
Freighters			F - 1	F - 2	F - 1		F - 12
Frankfurt							
Passengers	P - 18	P - 5	P - 28	P - 28	P - 13	P - 17	P - 22
Combis			C - 1	C - 2	C - 7	C - 4	
Freighters	F - 1			F - 2	F - 4	F - 1	F - 22
Luxembourg							
Passengers							
Combis							
Freighters		F - 3	F - 5	F - 4		F - 3	F - 10

Source: Air Cargo Timetable, ABC Guide, September 1994.

The concentration of weekly frequencies, especially that of pure freighter services, is limited to the few major European gateways of London, Amsterdam, Brussels, Paris, Frankfurt and Luxembourg Other European gateway airports are restricted in their number of freighter frequencies and the number of sea-air hub airports that operate them, such as:

1. Manchester, with five wide-bodied weekly freighter (B747) frequencies from Dubai International Airport. This frequency originates in Hong Kong and passes through Dubai International Airport in transit to Manchester, but with fifth freedom rights at Dubai Airport, which permits the carrier, Air Hong Kong, to uplift sea-air and other cargoes from Dubai and U.A.E.

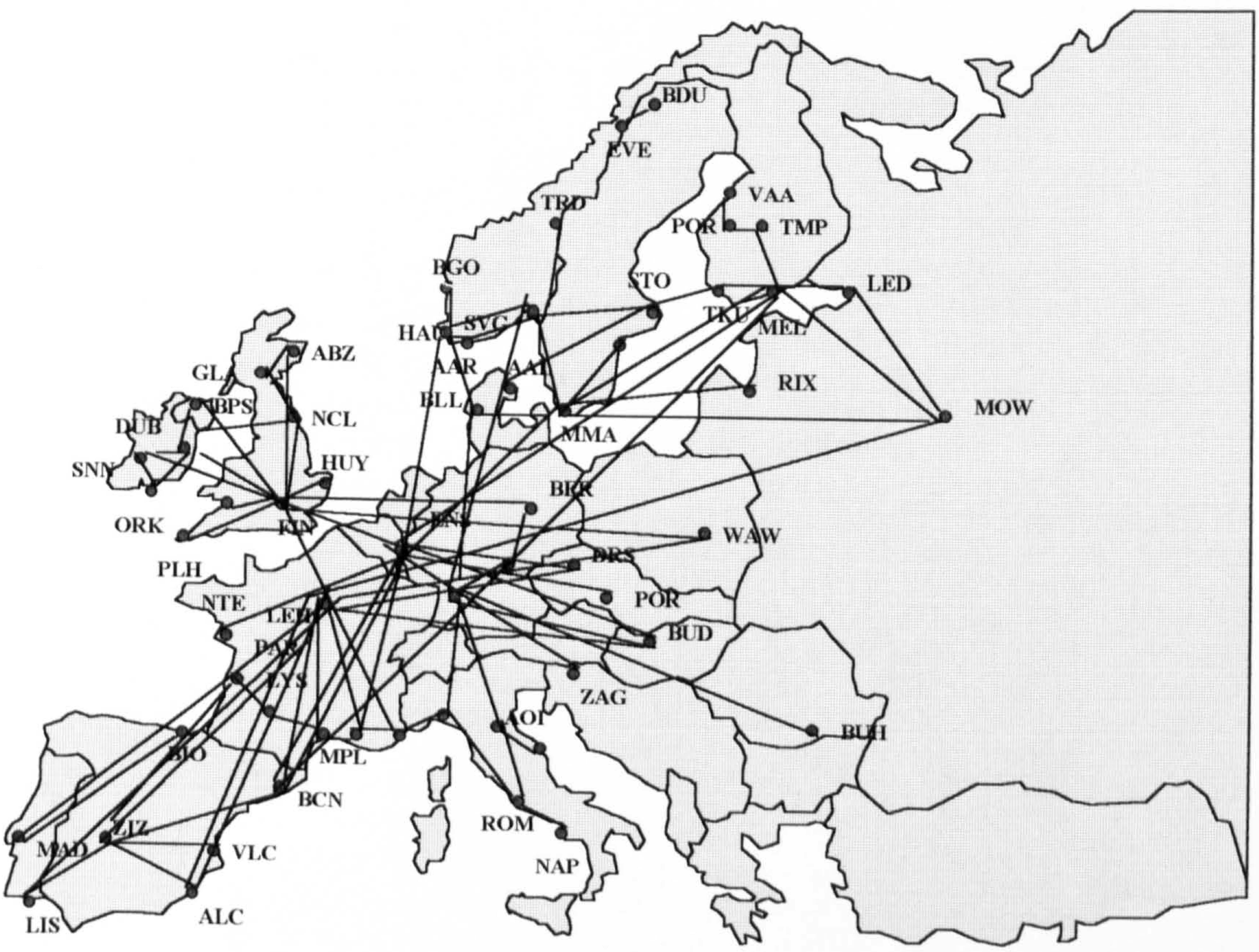
Other European gateway airports with pure freighter frequencies:

2. Milan, with 2 wide-bodied freighter frequencies from Los Angeles, operated by Alitalia.
3. Rome, with three weekly DC8 narrow-bodied pure freighter services operated by Alitalia and 2 combis, wide-bodied B747 frequencies operated by Malaysian Airlines, all from Dubai Airport, in addition to a once weekly B747 freighter frequency from Los Angeles, operated by Alitalia.
4. Basle, served by 4 weekly narrow-bodied B707 freighter services operated by TMA from Sharjah International Airport, via Beirut.

5. Lyon, served with 2 B747 freighter services operated by Air France from Dubai International Airport.
6. Copenhagen, served by two wide-bodied B747 freighter services, originating in Singapore and transiting Dubai, with fifth freedom rights.

An increase in scheduled international wide-bodied frequencies to the main gateway hubs encourages concentration of flight operations, and, therefore, the creation of high volume routes, which entail supporting services of another mode of transport for distribution of cargo from the major gateway airports to further destinations inland. In the case of Europe, the support of the trucking services is clearly shown through the increase of trucking frequencies from major European gateway hubs nominated earlier (see trucking chart below). The trucking services are required because connecting flights from these major gateway airports are mainly operated by narrow-bodied small size commuter aircraft, who do not have the time, due to the very fast turnround of these flights, nor the capacity to accommodate massive volumes of cargo. In addition, pure freighter services from major gateway airports to regional airports within Europe, are very rare and mostly operated on a charter basis.

Figure 21 : Development of Trucking Frequencies within Europe



These single links in a long logistic chain have prompted Lufthansa to tie up a punctual and regular truck service to their air cargo frequencies. The complementarity of the Lufthansa service is by their trucking network operating from Frankfurt to many airports in Northern Europe. The trucking system is operated on daily frequencies rendering a continuous flow of cargo from the time it is offloaded, from arriving aircraft to onboard truck, to final destination.

Many airlines followed suit, such as KLM and Singapore Airlines who established re-distribution hubs at Amsterdam and Copenhagen airports respectively. In 1994, Gulf Air offered a similar service of 5 weekly, cargo flights to a hub airport - Brussels, for further re-distribution by the DHL trucking network system to most airports in Europe.

From Sharjah and Dubai airports, many airlines offer combined air/truck services. Trans Mediterranean Airways and Kuwait Airways freighters use Amsterdam as their hub for overland re-distribution to the rest of Europe. Royal Jordanian freighters use Maastricht. Cargolux and China Airlines use Luxembourg.

The availability of so many flight frequencies and air/truck services covering almost any city in Europe, gives the sea-air forwarder more power and control over cargo movement because of his ability to offer his customers, at origin, the best possible connecting flights at the transfer point, so that shipments reach final destination in the shortest possible transit time.

Despite the airline involvement with overland transport at the airport of final destination, which is usually a major gateway airport from which regular and scheduled airline trucking services extend deliveries to the smaller regional airports nearest to the actual final consignee, airlines were denied accessibility to the actual final consignees because :

1. The freight forwarder at the sea-air transfer hub consignees the airline Air Waybill to his agent at the airport of destination, whereby airline truck deliveries are made to the nominated agent and not the actual consignee.

2. The agent or freight forwarder at the airport of final destination is in a much stronger position, as he interfaces directly with the consignees and offers them an array of services such as, warehousing and distribution logistics that minimizes the end user's stockpiling and inventory costs.

In general, the offers by the freight forwarder at destination airports, of storage and distribution services, attracts a large number of medium to small importers who benefit from the lower charges derived from the economics of scale.

9.3 Freight forwarders

The task of the forwarder, in the national economy, is to link the demand for transport with the offer of the transport operator. The forwarder manages and controls the movement of goods from one point to another in the safest, fastest and most economical way. Control is kept through a network of correspondents/associates or even through branches. Further, he acts as consultant by supplying exact information as to the cost of the various modes of transport, correct packing, documentation, banking procedures, customs clearance and consular requirements.

The forwarder works for several operators, and is able to evaluate various possibilities available in the market, at any one moment in time. He, therefore, can offer the most efficient means of transport to the customers, with the primary function of combining the interests of both the customer and the operator. The forwarder's job is to force the operator to improve his offers, by various means, such as faster communication, better frequencies and reliable schedules. The forwarder accumulates immense know-how of most, if not all, available transport trends and offers in the market. It follows that the initiative to build up a reliable sea-air service is motivated by the freight forwarders.

This section highlights the role of freight forwarders in the development of sea-air transfer hubs. The freight forwarders' traditional role lies between shippers and carriers in the range of services offered, such as:

1. Pick up from shipper's factory, arranging documentation, legalisation of invoices, preparation of packing lists, insurance, and even packing the consignment itself at origin.
2. Offering the shipper the widest possible choices of transport routes, rates and transit time.
3. Customs clearance and door deliveries to consignees at destination.

Traditionally, the freight forwarder offering the above services is not burdened with heavy capital investment in acquiring transport equipment that other transport modes are burdened with, such as large container ships, aircraft, rail-cars and heavy duty trucks and tractors.

The factor of relatively light investments by the freight forwarders helped in the emergence of specialisation. In the early 1980s, a trend to specialise in the provision of a certain service, or a group of related services, to shippers and consignees, took form and many specialist freight forwarders surfaced in the world markets, a trend that appealed strongly to shippers and consignees, and helped the shift of freight control from the carriers to the specialised freight forwarder.

9.3.1. Custom House brokerage

Those forwarders specialise in customs clearance pick up and overland deliveries to their clientele, the shippers and the consignees.

Historically, the Custom House Broker was the first organisation to act as a middle-man between the shippers and the carriers. They offered the service of 'arranging' transportation of goods from one point to another, on behalf of their clients in their capacity as 'agent' to the means of transport, the carriers.

In order to facilitate, enhance and administer the role and activities of the agent, carriers subjected the appointment of their representatives (agents) to strict rules and regulations, and defined compensation of their services in terms of a percentage commission applicable to the published carrier's rates of transport. Air carriers were the pioneers in this subject; they initiated rules and regulations through their 'International Air Transport Association' (IATA) that produced a worldwide network of IATA appointed agencies.

Before an agent receives appointment as an IATA cargo agent he should be able to :

a. Demonstrate sound financial status.
b. Employ qualified, certified staff able to handle all kinds of shipments, including dangerous cargo consignments.
c. Own or lease adequate cargo handling facilities, open to the public.
d. Maintain proper IATA approved accounting procedures, such as invoicing customers and collecting monies according to IATA rates and remitting the same to its principal, 'the airline', within thirty days of the carrier's invoicing date, less his IATA commissions.

Once appointed by IATA, the agent receives a stock of the airline's airway bills, serially numbered, which must be used serially, without interruption. Nowadays, as computerisation is widespread, a neutral airway bill stock is produced by the agent and the airline renumerates the agents with an agreed upon fee covering the cost of the document.

The IATA appointed agent must strictly observe IATA approved conditions of carriage, and all rules regulating his conduct with the customers and general public. The agent's role is to print the Airline Airway Bill with all the relevant details of a shipment, on behalf of the carrier, and deliver it completed, to all concerned parties. The airline airway bill becomes the contract of carriage between the customer and the carrier, through its agent. The scope of the agent's activities are:

Exports: shipments are picked up ex shipper's factory with packing lists and shipper's invoices which may require legalisation and certification from the relevant sources such as the Chamber of Commerce and the resident Consul of the country of destination. Insurance policies are issued, if required, and marking, labelling and numbering of each package is done, and an Air Waybill is issued on delivery to the airline at the exit airport. In brief, all steps are executed by the Custom House Broker to render the shipment 'ready for carriage'.

Imports: shipments are custom cleared vide a letter of appointment by the consignee to his agent, authorising him to clear on his behalf; duty paid (later invoiced) and the shipment is delivered directly to consignee's door.

In both cases, of imports and exports, the customs house broker is the middle-man who interfaces directly with the carriers and the customers.

9.3.2. The Consolidator

From the very first time that air carriers established the quantity rate structures, freight forwarders started their consolidation services which were made available to the general public, through publications, periodicals, pamphlets and advertisements, stating :

a. Scheduled regular consolidation services.
b. Published rates per kilogramme per total weight of shipment according to a scale of weight breaks that were much lower than the airline rates.

Consolidation services took full advantage of the air carrier's rate structure which decreases progressively as shipment weight increases. They grouped a number of individual consignments into one large consignment, and air-freighted it at the air carrier's lower rates applicable to greater weight consignments.

Freight forwarders specialising in this field usually concentrate their efforts in the market of small size, small weight,regular shipments. They may collect these shipments directly from shippers or from smaller freight forwarders or custom house brokers, and consolidate all into one large shipment, thus taking full advantage of carrier's quantity rates. The carriers themselves are basically responsible for the emergence of the consolidators.

Carriers, i.e the airlines and shipping lines, have established a large array of rates with various structures that yield advantages and benefits to the shippers, on strict application. The most common group of carrier's rates are those of quantity. The larger the quantity, the lower the rate of carriage from one airport to another. For example; the published air rates applicable in September 1994 between London Airport and New York Airport were as follows:

M	=	Pounds Sterling 50.00
N	=	Pounds Sterling 3.93/kg
Q 300	=	Pounds Sterling 2.05/kg
Q 100	=	Pounds Sterling 1.24/kg

Q 500 = Pounds Sterling 1.14/kg

M = means minimum per shipment. A minimum is set at Pounds Sterling 50.00 for shipment weight which, when charged at the N rate does not yield Pounds Sterling 50.00 and, therefore, is charged the minimum of Pounds Sterling 50.00.

N = shipments weighing up to 45 kgs each. This rate is applied for shipments weights yielding more than the minimum Pounds Sterling 50.00, when the weight in kgs is multiplied by the N rate of Pounds Sterling 3.93/kg.

Q 100 = quantities of 100 kgs per shipment are charged at Pounds Sterling 2.05/kg rate.

Q 300 = quantities of 300 kgs per shipment are charged at Pounds Sterling 1.24/kg rate.

Q 500 = quantities of 500 kgs per shipment are charged at Pounds Sterling 1.14/kg rate.

This shows the advantage of consolidated smaller shipments to the 500 kgs weight break. The shipper (customer) is usually given part of the benefit, while most of it is retained and/or shared between the large consolidator and smaller broker, who co-loads his small shipments with the large consolidator.

In addition to the consolidation high margin of profit, as seen above, the quantity rates are commissionable, i.e. subject to the mandatory 5% freight forwarder's commission. Further, airlines have established other incentives to the consolidators, such as special rates applicable to certain commodities. They are called specific commodity rates - grouped, numbered and classified according to IATA master item numbering and a group description list.

Within the specific commodity rates structure, a quantity discount applies as well. For example; from London Airport to New York Airport, a specific commodity rate applies for ICI products under item No. 9960, for weights of 300 kgs and over, per shipment, on Continental Airlines, at Pounds Sterling 0.92/kg.

Many other classes of rate apply, in the airline and shipping line industry, with advantages given to higher weights or the bulk movement of cargo, such as the shipping line's container rates which gives contractual special discounted rates for shipments of 100, 200, 300 containers during a specified period of time. Or the airline ULD (Unit Load Devices), special rates for cargoes loaded in these devices.

The emergence of the 'consolidators' at airports of origin, i.e. where the freight is first generated, entails the presence of a 'break-bulker' at the point of destination. Thus, the third speciality: the 'break-bulker'.

9.3.3 The break-bulker

Break-bulkers are mostly located at the main gateway airports of largely importing countries. The consolidators at origin prepare a consolidated shipment in the following manner :

a. Each individual shipment is processed and made ready for carriage, as explained earlier, with only one difference, and that is a 'House Airway Bill' is issued instead of an Airline Airway Bill. A 'House Airway Bill' is an Airway Bill produced by the consolidator carrying his trade title and his conditions of carriage. The 'House Airway Bill' is similar in almost all respects to the Airline Airway Bill and may differ in the 'conditions of carriage', which are printed on its back page. This document will be subject to detailed analysis later in this section. However, for the purposes of the consolidation process and break-bulk, the 'House Airway Bill' is the only document that the shipper and consignee get, and consignees receive their consignments through this document, and shippers get their letter of credits processed through banks at origin, via this document.

b. All 'House Airway Bills' of a consolidated shipment are grouped and listed as per cargo manifest issued by the consolidator, showing :

  - The number of each 'House Way Bill'.
  - The weight in kgs and the chargeable weight (high density, low density etc.).
  - The nature of the goods.
  - The number of packages in each consignment.
  - The shipper's and consignee's full names, addresses, telephone numbers, fax numbers, P.O. Box numbers, etc.

All 'House Airway Bills' are attached to the cargo manifest, and a 'Master Airline Airway Bill', covering the whole consolidated shipment, is issued by the consolidator as shipper, and addressed to the break-bulker at the destination airport, as consignee. The actual shipper's and consignee's trade titles do not appear at all on the 'Master Airway Bill'

As the break-bulker receives the consolidated shipment, he breaks it into individual shipments as per the 'House Airway Bills' and the consolidation manifest. At this point, the break-bulker consults with the consignee for his disposal instructions. This means that the break-bulker interfaces directly with the consignee who may entrust him with custom clearance and delivery of the shipment. In case the consignee is satisfied, then the break-bulker may be able to solicit future air consignments' carriage via the same system, by requesting the consignee to issue instructions to his shippers at the points of origin to entrust future shipments to the very same consolidator. As such, the control of cargo flow is diverted to the freight forwarding network of consolidators, break-bulkers and Custom House brokers.

9.3.4 The sea-air operators

As the consolidators role grew rapidly, dealing directly with shippers and consignees, and offering door-to-door collection and delivery of freight, large consolidators started publishing their own through-rates, flight and ocean voyage schedules, using their own 'House Airway Bills'. The only factor that would have transformed them into carriers was the ownership of the means of transport; ships, aircraft, trucks and railways, which they did at a later stage, and became known as the "integrators".

As 'Non Vessel Owning Common Carriers' (NVOCC), freight forwarders acting as carriers, without owning means of transport, assume the responsibility of the complete chain of transportation required by their customers; in fact, they offered a much wider service than the carriers, and that is the 'door-to-door' services. They were able to set up their own route and quote their own freight rates, a single freight rate ex-factory to consignee's door at destination, and a combined transport document with a defined liability to total or partial loss or damage to the consignment.

The consolidators, the freight forwarders, the NVOCCs and sea-air operators are different titles given to practically one entity that is able to offer shippers and consignees a 'door-to-door' collection and delivery of consignments through a 'House Waybill', which was developed into a Combined Transport Document (CTD), basically because a 'door-to-door' service involved a combination of various modes of transport.

Originally, the 'House Waybill' covered the carriage of the consignment airport to airport, and the 'House Bill of Lading' covered the carriage from port to port. Shipments, however, were collected ex factory, which meant overland transport ex factory to the airport or the port at origin and overland transport from the airport or port of destination to consignee's door. As consolidators and freight forwarders gained larger control of the market, through the 'door-to-door' services, insurance coverage of the overland sector was urged by shippers and consignees. This demand had a prompt response which came about with the introduction of the 'Combined Transport Document' replacing the 'House Waybill', with a 'door-to-door' defined liability, thus covering the risks of loss and/or damage that may occur during the overland carriage, whether at origin or destination. The liability is further analysed later in this section.

The interfacing process between the freight forwarder on one hand, and the shippers and consignees on the other, became stronger and reliable, as detailed data and information about costs of transport of each mode were exchanged. With the widespread use of container ships and wide-bodied aircraft, in addition to the dramatic progress in information technology and innovations in the field of communications and computerised information data bases in the early 1980s, a revival of the sea-air mode, that was first initiated, in the 1950s, by the freight forwarder 'Kuhne & Nagel', was thought to have much better prospects of success. So it was offered to shippers and consignees as a viable alternative to the high costs of direct air freight and the long transit time of ocean shipping.

Technically, the 'consolidator' at origin was able to play the role of a sea-air operator through the appointment of a 'break-bulker' - freight forwarder located at the sea-air transfer hub, as his 'Combined Transport Document' (CTD) was already in use and needed only the ocean segment liability to be covered, vis-á-vis his customers.

Operationally, how does a sea-air shipment operation differ from:
1. Direct air-freight or ocean-freight single shipment operations?
2. Direct air-freight or ocean-freight consolidated shipment operations?

At origin : A freight forwarder - consolidator - collects a shipment from his customer, the shipper, ex factory and prepares it for carriage whether by air or ocean, to final destination.

9.3.5 Direct air-freight single shipment

Once the shipment is ready for carriage, the freight forwarder issues an airline Airway Bill, as per shipper's instructions, showing all details such as the full name and address of the consignee, weight, number of packages, nature of goods etc., and books the consignment with the airline having the first available flight to the airport of destination.

The freight forwarder, himself, delivers the shipment to the airline receiving bay, at the airport of origin, against a cargo receipt issued by the airline, confirming the number of packages received and actual gross chargeable weight of the consignment, as verified by the airline's electronic scale, located adjacent to their cargo receiving bay. Volume measurement of the consignment, and therefore volume chargeable weight is also re-confirmed by the airline staff receiving the shipment. In case the shipment is voluminous, i.e if its volume is more than the 6 : 1 ratio currently applicable by the majority of airlines, from all six world regions, then whichever produces the greater revenue to the airline is charged.

This shipment may be received by the airline, already palletised or containerised in one of various airline ULDs (Unit Load Devices) and air-freighted to the airport of destination, under a single airline Airway Bill which may be consigned directly to the consignee, or to a freight forwarder located at the airport of destination.

At the destination airport : In the case where the shipment Airway Bill is consigned directly to the consignee, the airline immediately notifies the consignee by telephone, electronic mail or facsimile transmissions of the arrival of his shipment. Consignees are usually pre-alerted by the freight forwarder and/or the shipper at origin with an ETA (expected time of arrival) message of his shipment, stating Air Waybill number and flight details. The consignee's Custom House Broker, at the airport of destination, carries out the customs clearance and door deliveries.

In the case where the shipment is not consigned directly to a consignee, but to a freight forwarder - break-bulker, at the airport of destination. The question is : under what conditions is the freight forwarder at origin able to practice this kind of procedure, i.e to forward a single shipment consigned to another forwarder at destination, for later delivery to the actual consignee?

Answer: In cases where the freightage, insurance costs and other ancillary charges, from origin to destination, are collectable from the actual consignees.

The freight forwarder is instructed by the shipper to issue the airline Airway Bill on 'charges collect' basis. The forwarder is forced, therefore, by IATA regulations to quote the IATA published rate on the airline Air Waybill. Cutting an airline Air Waybill as per IATA rates, on 'charges collect' basis, at the airport of origin and addressed directly to the consignee at destination, whether the consignee is a freight forwarder or the actual final consignee, requires that the airline collect the freightage exactly as computed on their Air Waybill, i.e. the IATA rate x total chargeable weight regardless of the contractual rates or bulk rates, agreed upon between the airline and the freight forwarder at origin.

In order to avoid IATA rates and apply the contractual lower rates, freight forwarders simply issue two Air Waybills, the airline Air Waybill and their own - the House Air Waybill. The innovative use of two Air Waybills is referred to as 'back to back'.

a. The House Air Waybill is issued by the freight forwarders as per the shipper's instructions, showing actual shipper's and final consignee's , full address along with standard shipment particulars. Further, all collections, such as the agreed upon cost of freightage with consignee, ancillary charges and CODs are also shown on the House Airway Bill.

b. The airline Air Waybill is issued on prepaid basis, i.e. freightage costs from airport to airport are paid to the airline at origin, at agreed contractual or bulk rates. The shipper on the airline Air Waybill is the freight forwarder himself, and the consignee is his counterpart, another freight forwarder located at the airport of destination.

The difference is :

1. The airline Air Waybill is consigned to another freight

forwarder located at the airport of destination, and not to the actual final consignee.

2. The airline liability[1], covering partial or total loss or damage of the shipment is shifted to the freight forwarder who becomes the only party who is able to file a damage/loss claim against the airline since the freight forwarder is the shipper and consignee on the airline Air Waybill.

   In cases of damage or loss, partial or total, the freight forwarder entitled for delivery must make a complaint to the air carrier in writing, claiming for compensation with respect to :
   (a) Visible damage to the goods, immediately after discovery of the damage and at the latest within 14 days from receipt of the goods.
   (b) Other damage to the goods, within 14 days from the date of receipt of the goods.
   (c) Delay, within 21 days of the date when the goods are placed at his disposal, and
   (d) Non-delivery of the goods, within 120 days from the date of the issue of the Air Waybill.

   All rights to damages against a Carrier shall be extinguished unless an action is brought within two years from the date of arrival at the destination, or from the date on which the aircraft ought to have arrived, or from the date on which the transportation stopped.

3. The actual and final consignee and/or the actual shipper are also able to file a damage/loss claim only against their freight forwarder and as per liability defined in the conditions of carriage printed on the back page of the forwarder's House Airway Bill.

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[1] The exact wording of the airline liability limitations is quoted below, from the 'conditions of carriage' of a British Airways Airway Bill, currently in use, March 1995:
Quote :
"If the carriage involves an ultimate destination or stop in a country other than the country of departure, the Warsaw Convention may be applicable and the convention governs, and in most cases limits, the liability of the carrier in respect of loss, damage or delay to cargo, to 250 French gold francs per kilogramme, unless a higher value is declared in advance by the shipper and a supplementary charge is paid if required. The liability limit of 250 French gold francs per kilogramme is approximately US$ 20 per kilogramme, on the basis of US$ 42.22 per ounce of gold."

" If the sum entered on the face of the Air Waybill as 'Declared Value for Carriage' represents an amount in excess of the applicable limits of liability referred to in the above Notice and in these Conditions and if the shipper has paid any supplementary charge that may be required by the Carrier's tariffs, conditions of carriage or regulations, this shall constitute a special declaration of value and in this case Carrier's limit of liability shall be the sum so declared. Payment of claims shall be subject to proof of actual damages suffered."

"In cases of loss, damage or delay of part of the consignment, the weight to be taken into account in determining Carrier's limit of liability shall be only the weight of the package or packages concerned."

"Any exclusion or limitation of liability applicable to Carrier shall apply to and be for the benefit of Carrier's agents, servants and representatives and any person whose aircraft is used by Carrier for carriage and its agents, servants and representatives. For purposes of this provision Carrier acts herein as agent for all such persons"

"(a) Carrier undertakes to complete the carriage hereunder with reasonable despatch. Carrier may substitute alternate carriers or aircraft and may, without notice, and with due regard to the interest of the shipper, substitute other means of transportation. Carrier is authorised to select the routing or to change or deviate from the routing shown on the face hereof.
This sub-paragraph is applicable to/from USA when domestic carriage within USA is exempted from its provisions."
Unquote.

Most freight forwarders issue their House Waybills almost identical to the airline Air Waybill, with the same liabilities and conditions. In cases where damages are proved to have resulted from the negligence of the airline staff or explicitly proved that the damages occurred as a result of mis-handling of the consignment by the airline cargo handling agent, the claim by the actual shipper or the actual consignee for compensation from the freight forwarder can be passed to the air carrier; that is if the air carrier is still solvent at the time the compensation falls due for payment.

However, not all claims for compensation from the freight forwarder are easily 'passable' to the airline, as there is always a possibility that :

(a) The freight forwarder has himself mis-handled the stuffing of an airline ULD. The airline ULD is received by the airline already filled with cargo, with no apparent physical damage to the ULD itself, and, therefore, declines any responsibility for damages discovered at destination while unstuffing the ULD. Such unstuffing may reveal shortages of packages left behind somewhere at the airport of origin and are difficult to trace, or unstuffing may reveal the presence of already damaged packages.

(b) The same discrepancies in handling may occur to palletised cargo which may arrive at the destination airport with few pieces or packages left behind at an airport of origin. The forwarder must assume full responsibility and cannot pass this claim to the airline.

(c) In case the shipper declares a higher value to his shipment, in excess of liability limits, and pays an additional charge, extending therefore, the liability of the freight forwarder up to the declared value, the freight forwarder must declare this value on his House Air Waybill, but is not able to declare it on the Master Airline Air Waybill covering a consolidation of a number of individual shipments. As such, the freight forwarder becomes fully liable to settle the claim as per the declared value of the consignment.

As the 'back to back' single non-consolidated shipment arrives at the airport of final destination, a delivery order is issued by the carrier, or its representative, to the consignee, the freight forwarder (break-bulker), located at the airport. The final actual consignee is pre-alerted with the ETA of his by the forwarder at origin through electronic mail or facsimile transmission directly or through his appointed agents at the airport of destination. Customs clearance and door deliveries takes place as per the final consignee's instructions. The agent at the airport of destination collects all charges as per the House Air Waybill, and remits all monies, less his commission, to the forwarders at origin.

9.3.6 Direct air consolidated shipments :

Consolidation operations are exactly similar to 'back to back' single shipments, but the consolidation covers a 'group' of single shipments, consolidated together, with each having a House Air Waybill, and all are covered with one airline Air Waybill, referred to as the Master Air Waybill. The advantage to the consolidator is manifold:

1. The grouping of single consignments under one airline Air Waybill generates higher total weights.

2. The higher the weight of the consignment, the lower the rate offered by the airline, whether on a contractual basis or on a bulk case by case basis.

3. The mixing of single consignments into a 'groupage' generates advantage through the averaging of high and low density cargoes. Volume chargeable weight is levied on the basis of the 6 : 1 ratio. Single consignments are rated on the HWBs as per their individual measurement, but the consolidator is charged as per the total measurement of the consolidated consignment, or as per the fixed agreed-upon lump sum per pallet or container, or any Unit Load Device charge acceptable and agreed upon by the airline and the consolidator.

These advantages and benefits are so great that a share is allocated to all parties involved, starting with the consolidator and the shipper at origin and stretching to the break-bulker at the airport of destination, the sea-air operator at the transfer point - in the case of sea-air cargo movement - and finally the final consignee, who in fact pays all, in the form of a through selling rate as relayed to him by his shipper.

9.3.7 Direct Ocean Single shipments :

Since sea-air cargo moves almost entirely in containers and container ships, the analysis that follows is, therefore, limited to containerised cargo shipping.

In cases where a shipment constitutes a full 20 foot or 40 foot container load, the shipper may require the services of a freight forwarder or may call directly on the shipping line with his instructions regarding loading date and time, nature of goods, method of packaging etc. The shipping line dispatches the required container for loading ex factory. The shipper prepares invoices, packing lists and the legalised - certified invoices himself or through his forwarder. The shipping line moves the fully loaded container to its container yard for eventual loading on the relevant ship's voyage to the port of destination. The shipping line issues a Bill of Lading stating the number of containers shipped, the trade title, the full address of the consignee and the rate per container charged, regardless of the contents of the container, its weight (provided it does not exceed the maximum limit of 22 tonnes) and volume. In practice, the shipping lines do not certify the nature of goods, spelling out a phrase that exonerates them from any liability, with respect to the nature of the goods shipped. The phrase is printed on the Bill of Lading very clearly: **'the shipment is said to contain ......'**. **'Is said to contain'** means that the shipping line does not know for sure what this shipment consists of. Further, it does not state who said so ..... In addition 'said' gives the phrase a verbal connotation instead of a written confirmation. Such phrases belong to the nineteenth century and must be changed to comply with our day and age.

Following is an excerpt from a paper presented by Mr. Peter Jones, at a Sea-Air Conference, held in Sharjah, U.A.E. in May 1995, entitled 'Sea-Air: New Solutions to New Legal Problems'.

Quote: "The chief international convention governing transport of goods by sea is known as the Hague Rules, now modified in most jurisdictions by the Visby Amendments ("the Rules"). The Rules reflect their origins in the laissez-faire environment of the nineteenth century. They only apply 'tackle to tackle', i.e. when loading commences to completion of discharge. They antedate improvements in the safety of marine transport, and preserve exemptions in favour of a carrier for which any original justification has long since disappeared. They entitle a carrier to limit its liability to an amount that was fixed many decades before the container revolution. Despite increases effected by the Visby amendments, the level of these limits is significantly below the level applicable to air cargo." Unquote.

The liability of the shipping line is defined through its conditions of carriage as printed on the back page of the Bill of Lading, and is limited to a total compensation that shall in no circumstances whatsoever and howsoever arising exceed 2 SDRs per kilogramme of the gross weight of the goods lost or damaged. (SDR means Special Drawing Right as defined by the International Monetary Fund - 2 SDRs are approximately equivalent to 2 US$).

If the Hague rules are applicable by national law of the country where a claim is made, the liability of the Carrier shall in no event, exceed the limit provided in the applicable national law of that country. If the Hague rules are applicable through other than by national law means, in determining the liability of the Carrier, the liability of the Carrier shall in no event, exceed Pounds Sterling 100.00 per package or unit.

In case a shipper claims higher compensation than that provided above, with respect to physical damages or losses to his consignment, such a claim will only be considered if the shipper has already declared the value of the goods prior to the commencement of the carriage and has stated such value on the Bill of Lading and approved by the carrier, an additional fee is levied to cover insurance of the declared value. In this case, the declared value substitutes the limits provided above. Any partial loss or damage claims are adjusted pro rata on the basis of such a declared value.

Compensation shall be calculated by reference to the value of goods at the place and time they are delivered to the consignee, or at the place and time they should have been delivered. For the purpose of determining the extent of the Carrier's liability for loss of or damage to the goods, the sound value of the goods is agreed to be the invoice value plus freight and insurance, if paid.

In case a shipper or consignee claims for compensation with respect to losses due to delay in receiving his consignment :

The carrier does not undertake that the goods shall arrive at the 'Port of Discharge' or 'Place of Delivery' at any particular time or to meet any particular market or use, and the carrier shall in no circumstances whatsoever and howsoever arising, be liable for direct, indirect or consequential loss or damage caused by delay.

9.3.8 Direct Ocean Consolidated shipments :

In the cases of smaller shipments that do not qualify for a full container load, and referred to as LCLs (Less than Full Container Loads), such LCL shipments are largely entrusted to a freight forwarder who collects them ex factory and prepares them to ready for carriage while temporarily stored in his warehouse. Once the shipment becomes ready for carriage, the freight forwarder contacts the relevant shipping line operating the required sailings to the port of destination, for loading the LCL shipments in containers compatible with the size of the LCL shipments in his possession.

The most commonly used container is the 20 foot container. The usable inner capacity of this container is 27cbm, and is able to carry a maximum weight of 22,000 kgs. The current, March 1995, rate per 20 foot container from main gateway ports of the Asia-Pacific region to the U.A.E ports is US$ 1325.00. Therefore the rate per cbm is US$ 1325.00 ÷ 27 cbm = US$ 49.00 per cbm. A large consolidator offering regular timely consolidations does not expect a perfect load for each of his 20 foot containers. An average load is drawn from long experiences and is set at 18cbm per 20 foot container. Therefore, the rate per cbm becomes US$ 1325.00 ÷ 18 cbm = US$ 73.60 per cbm.

Large consolidators publish their own LCL rates and shipping schedules, and make their profit through loads in excess of 18 cbm and up to a maximum of 27 cbm, which means that their prospects of making profits is still very high at 9 cbm (27 cbm - 18 cbm = 9cbm), which is 50% of the average chargeable load of 18 cbm.

Therefore, a direct ocean single shipment is executed as a part of a consolidated shipment. Whether the 'consolidation operation' is done by a shipping line or by a large freight forwarder, the charges per cbm are the same whether a house Bill of Lading or a shipping line Bill of Lading is issued.

In the case where the shipping line is offering a consolidation service, a shipping line Bill of Lading is issued to each single shipment in the consolidation. The shipping line, or its representative at the port of destination does not require a break-bulk service, as all the shipments in the container are already broken and require only the issuance of a delivery order to each consignee, as per his individual Bill of Lading. In the case of a large forwarder offering consolidated services, a House Bill of Lading is issued for each single shipment in the consolidation, and all the House B/Ls are covered with a shipping line Master Bill of Lading, consigned to a forwarder, break-bulker located at the port of destination. A break-bulker is required and each single shipment is treated on its merits; some are on collect basis, some are to be custom cleared and further transported by rail or truck deep inland to consignee's door, etc.

The expansion and the growing strength of the freight forwarding industry has widened much of its activities to cover regular contractual carriage of ocean cargo, thus producing a new terminology to this activity. A forwarder who regularly acts as a principal to a contract of ocean carriage is now called a Non-Vessel Owning Common Carrier or NVOCC.

In the U.S., the Federal Maritime Commission (FMC) regulates waterborne commerce to and from the United States in much similar ways than IATA regulates air traffic flow in Europe and the rest of the world. However, unlike IATA, the FMC generates its powers from the U.S. Shipping Act of January 1984, which requires 'common carriers' of goods by water to file a tariff of their freight charges with the FMC, whose duty is to ensure that shipping lines and other entities acting as 'common carriers' do not engage in anti-competitive monopolistic activities.

A common carrier must satisfy the conditions of the U.S. Shipping Act as a pre-requisite to its eligibility to practice common carriage. The U.S. Shipping Act defines a 'common carrier' as follows:

"a common carrier is a person holding itself out to the general public to provide transportation by water between the United States and a foreign country for compensation that.......

a. assumes responsibility from the point of receipt to the point of destination, and
b. utilises for all or part of that transportation a vessel."

The FMC distinguished NVOCCs from shipping lines, by the following definition of NVOCCs:

"Non-vessel-operating common carrier means a common carrier that does not operate the vessels by which the ocean transportation is provided and is a shipper in its relationship with an ocean common carrier".

This term became popular in forwarding terminology outside the U.S. as a convenient phrase to describe the services of a transportation contractor. There is no equivalent term applying to air carriage of goods where freight forwarders are generally known as air consolidators.

The key characteristics of a common carrier is that its services hold out, i.e. are open to the general public as a provider of transportation services for compensation. Open to the public means that the services of a common carrier are available to any party, and are publicised through the media in the form of:

1. Regular scheduled services from one point to another.
2. A schedule of tariffs covering transport charges.
3. A fixed place or places for receiving cargo.

Under FMC regulations, a common carrier of goods by water is required to:

1. File a tariff

   The principle behind this filing is that prices charged for ocean carriage must be available to all users without discrimination. By requiring equality of treatment between users, anti-competitive practices can be held in check. To achieve this, the FMC requires that these prices be incorporated in a tariff filed with the FMC and available for inspection by any interested party. Like the ocean carrier, the NVOCC has to file tariffs. An ocean carrier or NVOCC that fails to file a tariff is subject to fines of the maximum amount of US$ 1,000.00 per day.

   The FMC requires that any changes in its charges by the NVOCC be incorporated in amendments to its tariff. In this respect, the NVOCC is in the same position as the ocean carrier. Failure to file amendments to its tariff is also an offence under the law, exposing the NVOCC to fines of the maximum amount of US$ 1,000.00 per day.

   A tariff rate may be reduced, but the lower rate cannot be charged until 24 hours after filing an amendment to the tariff with the FMC. A tariff rate may be increased, and the higher rate be charged 30 days after filing. A NVOCC cannot charge a lower rate intending to validate its price by subsequently filing an amendment. If the rate charged on the date of the shipment is not the tariff rate, the NVOCC is in violation of the law.

2. File a bond

   A NVOCC is required to file a bond issued by an acceptable

U.S. surety company, in the amount of US$ 50,000.00. The bond will be available to pay any judgment for damages against a NVOCC arising from its transportation related activities, a FMC order for reparations, or any penalty assessed against the NVOCC by the FMC. Once a complaint is filed, the FMC has a wide jurisdiction, and may also direct the party investigated to pay amounts in addition to the penalty prescribed by law. In the event of an unsatisfied claim, the FMC may collect the amount of the bond from the surety company and distribute it among the persons having claims against the defaulting NVOCC.

or

file a liability insurance that the FMC judges as adequate protection for U.S. claimants, and that also allows recovery of civil penalties imposed by the FMC under the Shipping Act of January 1984.

In order to protect recovery of civil penalties imposed by the FMC on foreign NVOCCs, practising business to/from or through the U.S., the FMC requires that: a foreign NVOCC appoint a resident agent in the U.S. on whom legal proceedings can be served. These legal proceedings include any complaint alleging violation of the Shipping Act or the FMC regulations. It could also include any action by any cargo owner or its insurer claiming for breach of duty in the carriage of goods.

3. Other requirements :

The filing of the form of the bill of lading used in its service, and any agreement between it and another common carrier; the keeping of proper books and records, with specific reference to the itemisation of disbursements and other major operational expenses are mandatory requirements by International Associations in almost the same manner applicable by the FMC.

However, the code of good conduct required by the FMC is enforced with relatively high penalties which are meant to curb the malpractice of giving any unreasonable preference or advantage to any one shipper, sharing of revenues with a third party or parties, and providing any free or reduced rates, below that already filed with the FMC, such as rebating.

In Europe, the Asia-Pacific region and some parts of the world excluding the Americas, the freight forwarding industry's activities are regulated by largely two international associations, IATA and FIATA and very few regional organisations that have relatively minor impacts on the flow of cargo in between the three main regions of the world (Asia-Pacific, Europe and North America).

IATA, as discussed earlier, regulates the flow of the air-freight cargo movements, through rules and regulations. Freight forwarders abiding by IATA rules and regulations are appointed as IATA approved agents.

FIATA (International Federation of Freight Forwarders Association) is an international freight forwarders association, with the main objective of regulating ocean traffic. Freight forwarder eligibility for FIATA membership is subjected to the FIATA initial requirement of an active national freight forwarding association in the country of the freight forwarder applying for membership.

FIATA's main contribution to the freight forwarding industry was its success in introducing a FIATA Bill of Lading which covered multimodal transport of mainly two modes; ocean and overland. This FBL (FIATA Bill of Lading) is similar in all respects to a House Bill of Lading issued by a freight forwarder - consolidator, under which a forwarder undertakes to carry its customer's goods from the place of receipt to the place of delivery. For the part of the transport not carried by the freight forwarder's own equipment, mostly the ocean part, the freight forwarder employs the services of a carrier. The forwarder was fully responsible for the performance of the entire transport chain.

A FIATA Bill of Lading is issued by freight forwarders and consolidators once they became FIATA members, by inserting the FIATA logo on their own House Bill of Lading. The FBL logo was believed to evoke confidence, trust and reliability in the freight forwarder vis-á-vis his customers. Customers were now given the same House B/L with a FIATA logo on it, which did not help much in Letter of Credit transactions of the importer's and the exporter's banks. Banks simply refused to accept these House Bills of Lading as a legal documentary evidence of shipping the goods, unless explicitly instructed by the party, who opened the letter of credit.

In 1968, FIATA produced a standard FBL and applied for recognition of this FBL by the International Chamber of Commerce (ICC) based in Paris. The main function of the ICC is recommendational, with no effective enforcement on the Letter of Credit general practices. The FBL was recognized by the ICC as an acceptable transport document only in 1983, through the publication of the revision of Uniform Customs and Practice for Documentary Credits (UCP) no. 400.

The FBL document was not the only document accepted in UCP 400. Other freight forwarders who were not FIATA members, but acted as 'carriers' or agents to a named carrier, were also accepted by the ICC. However, the latest revision of the ICC - UCP 500, dropped all references to the FBL, undermining FIATA documents as produced by an organisation, not worthy of ICC consideration. That was the end of it...maybe...FIATA is currently, March 1995, requesting its members to convince their clientele, the shippers and the consignees of the advantages in the FBL's use as an acceptable transport document in letter of credit transactions, offering solid commercial and legal protection. The researcher is of the opinion that FIATA documents are bound to fade away from the market place and finally disappear due mainly to the facts that :

1. FIATA documents depend on the recognition of other international institutions for their acceptability by the general public and the banking institutions. They do not depend on themselves to gain acceptability and reliability.
2. FIATA membership is restricted to the national freight forwarding associations of the country of the freight forwarder applying for membership, and the granting of membership is not subjected to any conditions or observance of any specific rules and regulations, other than the licence issued by the relevant authorities of that country.
3. FIATA documents are wide open for malpractice, specially by the smaller forwarder, and with relatively low levels of enforcement, malpractice could become wide-spread.
4. Many major world freight forwarders are currently in a much stronger position, than FIATA, to introduce their own document, offering their clientele a strong, successful and reliable document, showing their own trade titles and logos.

In Europe and the Asia-Pacific region, freight forwarders still seek to be IATA approved agents, as they still believe that the mere print of the IATA logo on their documents generates customer's confidence and reliability to their activities. Freight forwarding in these regions is only subject to the provisions of the relevant government's rules and regulations covering the legal issuance of a freight forwarding licence. A freight forwarder, through his government licence, is able to practice various related activities such as, a carrier's agency, freight forwarding, consolidation, sea-air operations and NVOCCs. All are practised without any legal restrictions or jurisdictions. While in the U.S., IATA is viewed as a cartel applying non-competitive practices and is not allowed to enforce its rates. The FMC remains the only body regulating water borne transport, and provides no legislation prohibiting the same enterprise from offering its services as a forwarder and as a NVOCC. The only restriction is that a forwarder charging its customers a NVOCC tariff cannot, at the same time, apply for a brokerage commission from the ocean carrier.

Having detailed the answers to the main questions of direct and consolidated airfreight on one hand and direct and consolidated ocean freight on the other, put forth earlier, it remains to be seen how sea-air operations differ.

9.3.9 Sea-air shipments

Sea-air operations do not differ technically from any of the four operations analysed earlier. Sea-air is a combination of the multiple operations of two modes. Under the first segment of a sea-air journey, direct ocean single shipments or direct ocean consolidated shipments are executed and consigned to a freight forwarder, at a sea-air transfer port. The forwarder receives these shipments and air freights them to the airport of final destination, either as direct single shipments or direct consolidated shipments. The only differences are:

1. Under sea-air, the freight forwarder practices full control over cargo flow from origin to destination, denying any accessibility to carriers. A sea-air shipment moves from its origin through a forwarder to another forwarder at a transfer point and then on to a third forwarder at the airport of destination and, therefore, becomes the exclusive domain of the freight forwarding industry.
2. The liability under a sea-air Combined Transport Document (CTD) in cases of damage or loss, partial or total is different from that of the ocean and air carriers.

The sea-air CTD is structured to protect the sea-air operator, the issuer of the document, as a contracting carrier, and protect also the actual carriers for their part of transport. Sea-air documents, now in use, incorporate clauses based on the Warsaw Convention and the Hague-Visby Protocol, to cover air carriage and ocean carriage segments, respectively, of the total journey.

Where a sea-air document is employed to the carriage of cargoes, a theory of a network of liability applies to the modes of transport used, and therefore subject to different limitations. The 'locality' where the loss or damage occurred becomes crucial in the settlement of a claim. In the event the 'locality' is not established, a claimant will naturally wish the application of air transport liability limits (which are the highest at US$ 20.00/kg). The air carriers are bound to resist payment due to the absence of proof as to the precise place where the damage or loss has occurred. The only solution to the resulting dispute is to make sure that procedures for inspection of goods at the time of transhipment, are thorough. However, in reality, this is seldom practised, as speed is vital for the commercial success of the sea-air service, and any interruption, for whatever purpose, becomes an obstructive factor in the attainment of the minimum transit time at the sea-air transfer hub. Besides, inspection procedures, if carried out, cannot be expected to eliminate such problems altogether.

The Hague-Visby Rules do not refer to delay and many ocean Bills of Lading exempt an issuer from liability for delay. Not so with the air carriers, whose Air Waybill contain an undertaking to perform the transport with 'reasonable despatch', thus resulting in more frequent claims for delay, against the airline. Sea-air carriers generally accept liability for delay, subject to a contractual limitation amount of twice the freight, which invariably would be well below the Warsaw Convention limit of US$ 20.00/kg. If the cause of the delay can be isolated exclusively to the air transport segment, the Warsaw limits will apply. If not, the limit of twice the freight applies.

In conclusion:

1. All world air carriers do not offer any consolidation rates and services to the general public. Some air carriers may still be building their own cargo pallets and ULDs at many airports of the world, but for single shipments rated as per the air carrier's published rates. Therefore, all air consolidators are operated and managed by the freight forwarding industry. This means that most of the small to medium size shipments and shippers (clients) are controlled by the freight forwarder.

2. The great majority of world shipping lines do not offer consolidation services. The very few who do, restrict it to certain high volume routes and, therefore, the majority of ocean consolidations are made by the freight forwarding industry.

3. As for the single direct shipment, ocean and air carriers concentrate their efforts on the larger clientele who are able to produce high volume and frequent freight movement, and offer them directly, quantity and bulk contractual rates. The carriers refrain from offering the same to smaller and medium size clientele in order to maintain their good relations with the freight forwarding industry, as a strained relationship will do them more harm than the limited business generated from their approach to this portion of the market.

4. Sea-air operations, covering all aspects of the series of transport links, include direct single as well as consolidated ocean and air shipments of various shapes and sizes, having low and high volume, and generated by a variety of clientele, remain exclusively under the control of the freight forwarding industry.

Chapter 10

Convertibility of ocean freight

The development and growth of freight load factors, over the last 25 years shows that in 1969, 44.5% of available cargo capacity on scheduled international airline operations was utilised. This utilisation rate grew to 46.3% in 1974, 50.3% in 1979, 56.8% in 1984, 57.6% in 1989 and dropped to 55.5% in 1994 (Table 5, page 18). This meant that unutilised cargo capacity of over 40% was and still is the major concern of air carriers, and questions as to where to get the cargo, to fill in these capacities, became pressing.

The main source, and probably the only source was to attract volumes of cargo from ocean transport. Hence the question, 'What kind of cargo could be diverted from ocean transport?'. To answer this question, 'captive cargoes' of each mode must be segregated. Two groups of goods appear captive to maritime transport.

1. Goods having large volume, low value per unit, low rate of perishability, occupying large space and which, therefore, can only be accommodated onboard ships.
2. Goods having large physical dimensions, regardless of their value per unit, requiring large space which cannot be accommodated on the widest of the wide-bodied aircraft in use, and, therefore, must be transported onboard ships, such as turbines, asphalt plants, power stations etc.

These two groups of goods are considered ocean 'captive' cargo and include a wide variety such as oil, ore, minerals, grain, chemicals, cement, steel, marble, granite etc. For such a group of commodities, the dominant mode of transport is ocean.

Goods that are considered 'captive' air cargo are characterised by their:

1. high value per unit,
2. high rate of perishability. This group includes live plants, flowers, fresh fruits and vegetables, medical supplies, baby poultry and hatching eggs, works of art, antiques, high quality leather products, furs, high fashion goods, newspapers, magazines, periodicals, etc.

The remaining group of commodities is the most difficult to define as it consists of a large variety of items that could utilise either of the two modes of transport. This group is neither ocean 'captive' nor air 'captive'. To characterise commodities within this group, the principal consideration is the total distribution cost factor with emphasis on the element of speed and the physical characteristics of the commodity under analysis.

Such a group of goods is considered divertible, and the choice of a certain mode of transport is governed by equally important factors which constitute an indivisible pattern, components of which must be considered altogether:

1. Reliability of the mode of transport.
2. Total freight costs and charges ex-factory, at origin, to the final consignee and the end user in the market place at destination.
3. Total transit time from origin to end user.
4. Value per unit of the commodity (per kg or per tonne).
5. Consignee requirement of delivery within a specified period of time.
6. Volume to weight ratio of the shipment (size/weight).

In order to divert part of the divertible group of commodities to direct air freight, from ocean transport, strenuous efforts were made and campaigns were launched on two major fronts.

The first campaign was aimed at the divertible ocean cargo group of commodities. Air carriers, aircraft manufacturers and related industries financed research studies , lectures and articles, in transport periodicals, all aimed at convincing shippers and consignees that air cargo transport was not as costly as it looked, when total distribution costs were considered.

The second campaign came from within the airline industry itself. Air carriers started to rationalise their operating costs. The objective was to reduce the costs of operation, and thereby the cost of air cargo transport. The ability to offer lower air freight rates in the market, to stimulate demand, and at the same time maintain profitability, became the target of most airlines.

10.1. Air cargo total distribution cost concept :

To start, the reliability of a transport mode is of utmost importance in determining its success. Reliability is gained over a period of time through the regularity of a transport mode, services providing scheduled voyages or flights between any two points. In addition, the promptness of applying a certain number of frequencies per day, per week, per month, etc. and the consistent recurrence of handling procedures available to clientele cargoes at origin and destinations, evokes confidence and trust in that mode of transport, and, hence, reliability.

To analyse the air freight cost in relation to total distribution cost, cargo movements must be traced from the very origin ex-factory at centres of supply, to the consignee's door at the markets of demand. During the process of monitoring air cargo, total distribution costs, the speed of air cargo as a competitive edge, must be highlighted as a supporting factor.

Short transit time is obviously one of the main advantages of air cargo transport. Time savings, when compared with other modes of transport, becomes essential to the air carriage of certain goods, especially with the added facility of frequency of air cargo flights. The number of flights per day, or per week, available to shippers and consignees to use for their cargo movements, becomes vital to the transport of certain goods.

1. High value goods, which are in demand at far away market places, thus reducing time between production and sale.
2. Commodities which involve substantial capital, tied up in stockpiling, are air-freighted in order to save on capital[1]. (fresh produce and urgently required goods are dropped from this analysis as they are captive air freight shipments).

The nature of air cargo is characterised by its perishability and high value. Air carriage of high value goods is done in order to reach the destination in a safe condition. Further, high value goods have the ability to absorb the high cost of air transport, at a fraction of its price at the consumer's market.

The 1994 'World Air Cargo Forecast by Boeing Commercial Airplane Group' describes finding in the U.S. import/export market by air, a positive relationship between air freight potential and value per kg of goods. "Each U.S. export and import commodity was placed into a unit value range depending on average value per kilogram. When air tonnes were plotted against these values, a distinct co-relation is noted. Air penetration is generally higher by value groups for exports than imports". This difference was attributed to intensive marketing efforts to stimulate air exports, while the relatively strong dollar vis-á-vis other currencies, during the period under analysis, constituted the main factor responsible for lower value air imports. US air-borne import/export commodities in 1993 showed the following percentage of air penetration vis-á-vis commodity value. (Total air exports were 1,978,262 tonnes and total air imports was 1,985,850 tonnes in 1993).

Table 88. Air penetration by value of commodities, 1993.

Commodity value in US$/kg	*% of total air imports*	*% of total air exports*
Over $ 16.00 / kg	45.3 %	51.4 %
$ 14.00 - 16.00 /kg	9.8 %	9.5 %
$ 12.00 - 14.00 /kg	6.2 %	6.5 %
$ 10.00 - 12.00 /kg	5.3 %	3.3 %
$ 8.00 - 10.00 /kg	5.6 %	5.7 %
$ 6.00 - 8.00 /kg	4.2 %	1.6 %
$ 4.00 - 6.00 /kg	3.9 %	2.2 %
$ 2.00 - 4.00 /kg	19.7 %	19.8 %
	100 %	**100 %**

Source : Boeing World Air Cargo Forecast 1994, Commercial Airplane Group

1. Capital: Goods whose fast supply by air results in savings in stock levels to be maintained, and hence savings in capital. Example: spare parts.

Values of commodities ranging from US$ 14.00/kg and over, represented more than 60% of total air imports and air exports. The top nine potential commodity groups reported by the Boeing World Air Cargo Forecast 1994 are :

1. Personal Computers and equipment
2. Sound recording equipment
3. Footwear
4. Photocopying equipment
5. Apparel
6. Engines/motors and non-electricals
7. Measuring and technical instruments
8. Telecommunications equipment
9. Auto spare parts and general spares

One more aspect of commodity values is noteworthy. Because unit value is frequently used to identify potential markets, air freight might be assumed to be limited to high-value commodities. However, Table 88, on the preceding page, tells a different story. Although over 60% of all U.S. air trade in 1993 possessed values of US$ 14.00 to US$ 16.00 per kg, or more, a significant portion of tonnage had far lower values. Almost 20% of all air tonnes, in fact were valued below US$ 4.00 per kg. This table offers evidence that air tonnage is not confined to high-value commodities, and that many other commodity characteristics can be important in the choice of shipment mode, such as its demand at a certain market within a specified period of time, regardless of its value; example, general spare parts. As large portions of the top nine commodity groups, mentioned above, are still moving by ocean, tremendous market opportunities remain to be explored in favour of air freight.

Arguments favouring the airfreight mode pinpoint specific advantages in relation to various characteristics of the commodity, such as: Air cargo is able to save on capital tied up from door to door. This means that the short transit time of goods to destination, and their immediate availability to the consignees, replenishes capital as fast as the goods are sold. This saving is further enhanced by the availability of many flight frequencies, and the ability of the producers at origin, to stock readymade goods and air freight them immediately, as ordered. This diminishes the need for stockpiling at destination and, hence, a lower inventory cost in the market place. The market place is characterised here by the high cost of land, warehousing and labour, while the cost of the same at the production line at origin, is usually much less.

Further, seasonal goods must be sold at the markets of demand for as long as the season lasts, i.e. during a short period of time. The cost of air-freight becomes a convenience rather than a burden; to seize the opportunity of selling a seasonal product becomes an opportunity cost to the producer. Air-freight, as such, is an advantage regardless of its cost (e.g., during 2 - 3 weeks in early July, it is possible to cover the cost of air freighting, first in season grapes from Crete to London, before grapes are available, by truck, from Italy and France.[1].

By the same token, a commodity may become the subject of high demand at a certain period of time. In many cases demand can be forecasted, such as the Christmas season in the western world, and the Hajj season in the moslem world, and certain commodities can be produced in advance and air freighted in time.

High volume, low density goods are cheaper to transport by air than by ocean (detailed in the section below). This refers to the density of a shipment, and depends on the ratio between actual weight and measurement volume of the consignment. The chargeable unit of freight depends on the ratio between the load itself and the total volumetric loadable capacity of the transport mode.

10.2 The volume to weight ratio

Almost all researches and studies over the past thirty years argued in favour of the air freight mode by spotlighting high value commodities and their ability to absorb air transport costs at a fraction of their value, short transit times, their ability to drastically reduce the cost of inventory and stockpiling, and, therefore, the replenishment of capital as fast as the goods are sold at destination. Although the importance of these points cannot be denied, very little was said, or researched on the volume/weight ratio of a shipment. The findings of this research point out clearly that the measurement volume to weight ratio of a shipment could be the most important factor determining its eligibility for conversion from the ocean freight to the air freight mode.

In the absence of any adequate analysis of this ratio, a thorough analysis is deemed necessary for the full comprehension of the total cost distribution concept. The case studies presented in this section show, among other things, the importance of this volume to weight ratio in both the ocean and air freight modes in the computing of the transport cost of each.

In the air transport mode, the design of the aircraft and the type of engines used, set the limits for its maximum take-off weight, including usable capacities for air cargo in terms of weight. The emphasis here is on actual total weight permissible for safe take-offs. Therefore, the volumetric usable capacity becomes a neutral factor once the maximum total take-off weight of an aircraft is reached. For example : the maximum total take-off weight of the specially designed B747-200F freighter aircraft is 377.8 tonnes with a maximum net freight capacity of 123.4 tonnes, and a maximum usable volumetric capacity of 682 cubic metres. The loadable capacity by weight and volume is calculated in Appendix L.

Air cargo consignments are accepted as delivered in various

1. Example cited by Professor Doganis, Rigas, Head of the Department of Air Transport, Cranfield University, U.K., August 1994.

shapes, weights and volumes and cannot possibly conform 100% to the aircraft structural floor load limitations. Cargo weights must be spread out proportionally on the entire aircraft floor due to the maximum weight tolerance per square unit of measurement (sq. ft), as set by the manufacturers. Thus trimming of the declared total net freight weight capacity becomes necessary. The same reasoning is applied to the declared usable volume capacity. Air cargo consignments are not packed to conform with the contoured shape of the aircraft. In an interview in August 1994, Mr. Asghar Shirazi the Lufthansa Cargo Manager, Dubai, quoted; "full volume usable capacity, as declared by the manufacturers, can be reached only if we use liquid to fill it up".

The Lufthansa operations manual declares a usable total net payload (freight weight) of 102 tonnes for its B747-200F freighter, inclusive of all cargo on the main deck compartment and two lower deck cargo compartments, while, the Singapore Airlines manual declares a usable total net payload for the same B747-200F, freighter of 104 tonnes. For the latest B747-400F freighters, the usable net payload was announced by Singapore Airlines, on 5.7.1994, to accommodate 124 tonnes of cargo, which is about 20 tonnes and 34 cbm more than the B747-200F freighter.

The volume to weight ratio is not considered so long as the airlines derived their anticipated revenues from the maximum 102 to 104 tonnes actual weight payload. The volumetric actual usable capacity of 600 to 625 cubic metres was considered only when one tonne or 1000 kgs of cargo exceeded 6 cubic metres in volume. As such, volume weight was charged rather than actual weight in order to maintain and or increase airline revenues.

For example, for a shipment with an actual weight of 1000 kgs, and dimensions of the packages, length x width x height equalling 7 cubic metres, the chargeable volume weight would be 7 x 1000 kgs ÷ 6, i.e. 1166.6 kgs instead of 1000 kgs. The volume to weight ratio of this aircraft is 625 cbm ÷ 104 tonnes = 6 : 1, a fact which did not disturb the (International Air Transport Association) IATA established ratio of 6 : 1.

IATA Resolution 502 covering low density cargo was adopted early in 1948. At that time, the conversion was based on 7000 cubic centimetres equalling 1 kg, i.e. 7:1. The resolution was amended in October 1981[1] to reflect a conversion ratio of 6:1. The rationale behind this resolution was to maximize airline freight revenue from low density shipments. Airlines calculated their revenues, in this case, based on the assumption that air cargo came in a variety of shapes, sizes and weights, and, therefore, not all cargo was low density cargo. The mixture of high and low density cargo onboard provided the required revenues by using maximum actual weight and maximum chargeable volumetric weight. Put simply, airlines equate $6m^3$ with 1 tonne of weight.

1. IATA records point out that long before 1981, British Airways and then BEA (British European Airline) campaigned strongly to amend Resolution 502 to a ratio of 5 : 1, but were always met by wide objections of member airlines of the relevant IATA sub committees.

Similarly, in the shipping mode, limits are set on a ships' loadable capacity in terms of measurement volume. The design of a certain ship determines its volumetric usable capacity. It is, in fact, the major constraint to its volume usable capacity.

In 1969 'Tonnage Measurement of Ships Convention' adopted a new and unified system of measurement by which the tonnage of ships of all nations is determined. The Convention provides for gross and net tonnages, both of which are calculated independently. The gross tonnage is a realistic indication of the ship's size. It is based upon the moulded volume of the entire ship (hull plus erections and all enclosed spaces) with no deductions, exemptions or special allowance therefrom, while the net tonnage is a general indication of the ship's earning capacity. It is produced by a formula which is a function of the moulded volume of the cargo spaces, the number of passengers carried, the moulded depth of the ship and the summer draught.

A cargo ship's usable capacity is a function of the stowage system applied to various commodity loading characteristics in relation to available usable space onboard. The stowage factor of any commodity determines the volumetric capacity in cubic metres that a shipment of that commodity will occupy, and not the actual cubic measurement of a tonne of cargo. Stowage factors provide the proper space allowances for broken stowage[1] and dunnage[2].

Such allowances of extra space are for :

1. Shipments of irregular shape and size;
2. Palletised cargo;
3. Refrigerated consignments and extra space for air circulation;
4. Packing method and density to which the goods are pressed;
5. Conditions of bags - fully rounded or slack;
6. Last minute, rushed-in goods for loading; and,
7. Dead weight cargo such as, high dense, high gravity cargo in liquid form, barrels, drums and tanks etc.

In brief, a space allowance for various classes of commodities is taken for 'broken stowage' and applied to the actual cubic measurement of a tonne or weight scale as the case may be. Therefore, an accurate estimate of the ship's volume usable capacity in relation to stowed measurement cargo can be made. Space, therefore, becomes the most important source of revenue to the ship.

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1. Broken Stowage : is caused by the presence of pillars, stanchions, brackets , web frames etc. This results in space unsuitable for cargo loading. This space must be packed firmly with suitable dunnage to prevent movement of cargo during the voyage, and to maintain stability.

2. Dunnage in the form of collapsible timber, aluminium strips, battens, rattans, bundles of sticks, inflatable plastic bags, etc. may serve many purposes, depending on the nature of the cargo carried:

   a. Protection of cargo from damage and deterioration from contact with water, moisture, sweat and leakages from other cargo, bilges, ship sides, double bottom tanks, frames, bulkheads, brackets, etc. and provide ventilation and access of cool air to cargo requiring controlled temperature.
   b. Prevention of chafe and shock and maintaining stability by filling in broken stowage, i.e. spaces which cannot be used for cargo.
   c. Maintain ship's balance by evenly spreading loads of deep stowage.
   d. Provide working levels and gangways for labour to operate and serve.

The important finding here is that generally, high density cargo becomes less costly to transport by ocean, while low density cargo enjoys a clear advantage of lower costs by air. In air freight, a chargeable unit is set at 1000 kgs to be equivalent to 6 cubic metres. Volume does not become a chargeable factor in air freight until the 1000 kgs shipment volume exceeds 6 cubic metres[1]. In ocean transport, however, the chargeable unit is either 1000 kgs or 1 cbm, whichever is greater. For example, a consignment weighing 1 tonne and occupying 6 cubic metres of volume, with a chargeable tariff of US$ 100 per weight tonne or measurement tonne (cbm), will cost US $ 100 x 6cbm, i.e., US $ 600.00. This means that the chargeable volume weight of 6 tonnes or 6,000 kgs results in a rate of US$ 0.10 per kg. In air transport, however, the same consignment can move by air at five times the ocean chargeable rate per kg (i.e US$ 0.50/kg), and still remain cheaper than the ocean mode, because it will pay US$ 0.50/kg x 1,000 kgs, which is only US$ 500.

However, the increasing use of containers and container ships had its impact on the quotes per unit of volume basis. Container ships derived their revenues from quotes per full container size (container standard sizes varied from 20 ft to 40 ft to 45 ft to jumbo open top containers (Table 89 on the following page) regardless of actual cargo weights loaded inside the container. Maximum weight load limits were either imposed by the container manufacturer, taking into consideration maximum floor loads per square unit, or by the authorities in the countries through which the container moves[2].

If the shipping lines were to sell container capacities per cbm and not per box size, then the volume capacity computed according to the internal dimensions of the container is the maximum earning capacity. Such a capacity can be perfectly filled if liquid was to be used. It is, therefore, a notional volume capacity and the volume to weight ratio becomes also notional and does not reflect the real day to day workable ratio. A much more reasonable volume usable capacity is reached by considering various shapes, sizes and weights of individual consignments and a stowage factor allowance of 15 - 20%[3] be applied to the declared notional capacity to arrive at an adjusted and realistic volume to weight ratio.

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1. **6:1 ratio:** In case 6 cbm actual weight is higher than 1,000 kgs, then the actual weight is charged. In some areas of the world, such as the sub-continent of India, Taiwan and Singapore, a ratio of 7:1 is applied in order to reduce the cost of air freighting low density, high value goods, since these goods are of importance to the economic development of a certain sector of their economy, and, hence, air export of these goods maintains employment of a large segment of the population in that sector. Example, readymade garments of India, orchids of Singapore and computers of Taiwan.

2. The gross weight of a container and its contents must not exceed either the weight indicated on the container or the maximum weight limit imposed by the relevant authorities in the countries through which the container will move, whichever is less. Where any FCL exceeds these limits, the carrier reserves the right, at the merchant's sole risk and expense, without any responsibility whatsoever on behalf of the carrier, to repack the contents in one or more containers, or to make other arrangements as may be deemed appropriate by the carrier and to charge the additional cost involved. Wherever practical, repacking will take place in the presence of the merchant. Details of weight restrictions may be obtained from the carrier's offices.

3. 15 - 20 % Stowage factor allowance confirmed by shipping lines B/Ls, Freight Forwarders combined transport documents and FETA - Hong Kong Seminar on 'Sea-Air' March 1988. Appendix I.

Table 89. Notional and adjusted containers Volume to weight ratios

Dry Freight Container Designation	Declared Notional Vol/Wt. capacities m^3/tonne	Notional Vol/Wt ratio	Adjusted stowage factor Vol/Wt m^3/tonne	Adjusted Vol/Wt ratio 1tonne = cbm
40 ft dry freight	67.3/27.4	2.45	55/25	2.20
40 ft open top	64.0/26.0	2.46	58/25	2.32
40 ft reefer	54.9/25.9	2.11	50/25	2.00
40 ft dry high cube	75.8/27.2	2.78	68/25	2.72
40 ft reefer high cube	65.8/25.6	2.57	58/25	2.32
20 ft dry freight	33.0/22.1	1.49	27/20	1.35
20 ft open top	31.5/21.8	1.44	27/20	1.35
20 ft open top open side	31.0/21.2	1.46	27/20	1.35
	26.2/17.1	1.56	22/15	1.46

Source : Compiled from ISL, and an application of 15 - 20 % stowage factor allowance.

It should be noted that the volumetric capacity of a standard 40 ft dry freight container is slightly more than double that of a standard 20 ft container, while the dead-weight payload capacity of the 40 ft container is only 25 - 30% higher than the 20 ft dead-weight payload, and hence a much higher volume to weight ratio for the 40 ft container. It follows that the 40 ft standard dry freight container is most suitable for low dense cargo as it is able to accommodate an average of 55 cbm with an average dead-weight of 25 tonnes, i.e. a chargeable volume ratio of 2.20 to the tonne. While the standard 20 ft dry cargo container is suitable for all kinds of cargo, low dense, high dense and deadweight cargo as it is able to accommodate an average of 27 cbm with a dead-weight of 20 tonnes, i.e. a chargeable weight to volume ratio of 1.35 cbm to the tonne. The 20 ft container became much more popular and widely used by freight forwarders, consolidators, sea-air operators and shipping lines.

At least in theory, the use of containers and container ships has changed the 'bulk' volume to weight ratio of 1 tonne = 1 cbm to an increasing ratio starting from 1 tonne = 1.35 cbm in the case of the 20ft dry freight container, and upward to reach 1 tonne = 2.72 cbm in the case of the high cube 40 ft container (Table 89).

This means that the cost to shippers and consignees should be based on the maximum usable volumetric and weight capacity of the container used. In the case of the 20' container, maximum usable volumetric and weight capacity is 27 cbm of volume and 20 tonnes of deadweight, i.e shipments should be costed at 1 tonne = (27 cbm ÷ 20 tonnes) 1.35 cbm, whichever is greater.

In practice, this does not happen, as shippers are hardly able to fill 27 cbm in a 20′ container due to the odd sizes and shapes of the shipments, and therefore are forced to dispatch most of the shipments with much less than full container loads, at the cost of a full container. Shipping lines base their quotes per container as a unit. Each quote depends on the size of the container in use. However, for less than container loads (LCL), they join the freight forwarders and the consolidators in offering published LCL rates to shippers and consignees

The ultimate goal of the shipping lines, consolidators and freight forwarders is to maintain their high standard of reliability rating with the shippers and consignees, and, therefore, are compelled to dispatch the shipments as per confirmed booking on the shipping lines′ published voyage schedules. Consignments of various shapes and sizes are picked up from the shipper′s factory or warehouse, by freight forwarders or consolidators, and delivered to the shipping lines′ container terminal at port of origin, to ride the first available sailing from the port of origin to the port of destination. Shipments are loaded into containers and dispatched on time regardless of whether they occupy the full usable volumetric space or loadable freight weight of that container

In order to avoid possible losses on LCLs, shipping lines resorted to an averaged volumetric or weight charge per shipment. A shipment of 15 cbm was found to be available at any time, while shipments of 15 weight tonnes were rare to find. LCL rates were constructed to produce the revenue required from a full 20′ container chargeable load, by charging a volumetric rate per cbm based on 15 cbm per 20′ container instead of 27 cbm. This resulted in higher LCL rates per cbm.

Consolidators of LCL, namely shipping lines and freight forwarders, concentrated their efforts on the 20 ft dry freight containers and started applying a much higher rate per cbm to small individual shipments to make up for the loss in usable volumetric capacity of the container. For example : Maersk Shipping Lines quoted in August 1994, for a full 20 ft container load, port to port, from Hong Kong to Dubai, US $ 1350.00, while consolidator′s quotes ranged between US$ 60.00 to US $85.00 per cbm or tonne, for the same sector, depending on the size and measurement chargeable weight of the individual shipment; the higher the chargeable measurement weight of the shipment, the lesser the rate per cbm or tonne (Table 89, page 220).

If the full 20 ft container load rate of US$ 1350 were to apply to the 27 cbm, as a sum of individual cbm units, and if LCLs were readily available to produce, when grouped, 27 cbm per 20′ container, then the LCL rate would have normally been US$ 1350 ÷ 27 cbm = US$ 50.00 per cbm instead of US$ 85.00 to US$ 60.00 per cbm. The trick is in the application of higher rates per cbm and the old, well-established, well-known chargeable quote of 1 tonne = 1 cbm, whichever is greater, remains in effect.

In the case of low density LCL cargo; a consolidator fills a 20' container with a number of individual shipments grouped together with a total measurement volume of 20 cbm and a deadweight of 4.5 tonnes. The charge to the shippers is assessed according to the volumetric weight of each individual shipment, which are higher than its deadweight. As the highest rate of US$ 85.00 per cbm will be charged for small shipments (Table 93, below), therefore, 20 cbm x US$ 85.00 = US$ 1700, will be charged, which is much higher than the US$ 1350.00 shipping line rate per 20' container as a unit.

In the case of one single shipment with a volumetric chargeable weight of 20 cbm, and a deadweight of 4.5 tonnes, a much lower rate, anywhere between US$ 60.00 to US$ 85.00 per cbm, will be charged. Assuming a charge of US$ 70.00 per cbm x 20 cbm = US$ 1400.00, the charge is still higher than the shipping line rate of US$ 1350.00 per 20' container as a unit (Table 90, below).

In the case of high density LCL cargo; the consolidation of several individual high density shipments, such as metal spare parts, may result in a higher deadweight to volumetric ratio such as, 20 deadweight tonnes and 16 cbm. The charge that will apply is that of 1 cbm = 1 tonne, whichever is greater. In this case the deadweight is higher than the cbm volume. Therefore, 20 tonnes will be charged at US$ 85.00 per tonne x 20 tonnes = US$ 1700.00, which is much higher than Maersk's full 20 ft container rate of US$ 1,350.00.

Table 90: Shipping Lines'/Freight Forwarders' FCL and LCL rates (w/m), July 1994.

Sector:HongKong/Dubai	**FCL/20 ft**	**LCLs + 20 cbm**	**LCLs + 5cbm**
Maersk Lines	$1,350.00	$60.00/cbm	$ 75.50/cbm
A P L	$1,200.00	$60.00/cbm	$ 85.00/cbm
Senator Lines	$1,150.00	$60.00/cbm	$ 70.00/cbm
Cosco	$1,050.00	$60.00/cbm	$ 70.00/cbm
NYK	$1,325.00	$60.00/cbm	$ 75.50/cbm
Freight Forwarders	$1,250.00	$60.00/cbm	$ 75.00/cbm

Source: *Shipping Lines and Freight Forwarders 1994 quotes.*
w/m: weight or measurement, whichever is greater.

Notes:
The first column shows rates applicable on FCLs by various shipping lines and freight forwarders.
The second column shows rates applicable on LCLs subject to consolidation with other shipments, in the same container.
LCL + 20 cbm means individual shipments having a volumetric chargeable measurement of 20 cubic metres and over.
The third column, LCL + 5cbm means individual shipments having a volumetric chargeable volume of 5 cubic metres and over.

<u>Conclusions</u> :

1. Low density LCL cargo: The rate per cbm of a shipment varies with the volumetric capacity that a cbm of that shipment assumes in relation to the total usable volumetric capacity of a container. The higher the volume of usable capacity that a shipment cbm occupies, the lower is the rate per cbm.

2. High density LCL cargo: The rate per deadweight of a shipment varies with the total deadweight capacity of a container. The higher the deadweight tonnage of a single shipment, the higher is the chargeable rate per deadweight tonne.

Many shipping lines realised the higher earning from LCL (Less than full container load) shipments consolidation. In addition to their quest of maintaining their clientele, they started their own LCL consolidation services, similar in many respects to the already existing freight forwarders' services, though the rates applied per cbm were different. Examples are given in Table 90, on the preceding page: Rates in US $/20 ft FCLs and LCLs (consolidation rates/cbm) are quoted by various shipping lines and consolidators during 1994 with validity up to the end of Dec. 1994. The sector quoted is Hong Kong - Dubai, port to port.

Most high volume goods such as computers, monitors and related equipment, musical instruments, readymade garments, footwear, telecommunications equipment, vehicles, spare parts and the like, have a very low density and therefore produce an adverse weight to volume ratio in containerised ocean freight. Such commodities occupy the full average usable volumetric space of a 20 ft container, i.e. 27 cbm, when available in large quantities, with a deadweight ranging from 4 - 5 tonnes. In these cases, the unit charge per 20' container will apply.

On the air freight side, a similar development took place and Unit Load Devices (ULDs) were introduced. Until the mid 1960s, all cargo (freight, mail, baggage) was carried loosely loaded in the cargo holds of passenger aircraft and in small all cargo aircraft. The introduction of the then large all cargo aircraft, the B707 and the DC8 in the mid 1960s (though both aircraft first entered world service in 1958 and 1959 respectively, cargo versions or conversions did not come about until the mid 1960s).

This meant long turn-around time at airports due to the lengthy unloading/loading time involved in bulk cargo. In order to speed the ground handling process, pallets, together with fast loading/unloading equipment and suitably designed aircraft floors were introduced. Pallets were either rectangular or contoured to prevent damage to the aircraft interior, and, at the same time, make full use of the contoured volumetric shape of the aircraft loadable space.

Cargo itself, on pallets, required protection from damage, pilferage and weather conditions, while on the apron. Igloos, (non-structural shells or covers to the pallets) were introduced to provide the protection required. Pallets were met with immediate wide acceptance by the air carriers who were then dominantly passenger oriented carriers aiming for the shortest possible turnround time at airports. With the increasing use of pallets, it was found that the pallets were relatively unstable and vulnerable to shifting during the ground handling process.

To overcome this possibility of shifting, restraint systems to aircraft floors were introduced, giving much greater support to the cargo during air carriage. The standardisation of ULDs in the form of standardised dimensions of pallets, igloos and containers made them compatible with various aircraft types. Thus each type of aircraft had a compatible set of ULDs that rendered maximum space utilisation. The only drawback is that the present use of ULDs, whether air ULDs or ocean ULDs, entails consolidation and break-bulk of cargo at both ends of each segment of the sea-air journey. To avoid break-bulking, an intermodal ULD would bridge the gap, but is yet to be seen, as it is still in the experimental stages. The problems that are delaying its introduction are :

1. Air ULDs are relatively very light in weight and fragile for surface transport.

2. Surface ULDs are relatively very heavy, and not suited for efficient aircraft use.

3. Shapes of both vary greatly and a net loss sacrifice of space utilisation is envisaged in both air and surface modes before the successful introduction of standardised sizes of the would be intermodal ULDs can take place.

10.3 Total Distribution Costs

The following six case studies represent shipments of various commodities of values starting from US$ 4.00 to over US$ 20.00 per kg, and characterised by their low and high density nature (measurement volume to weight ratio) that are regularly moving by all three modes of transport, namely air, all ocean and sea-air. The aim of these case studies is to assess the relative costs of the three different modes of transport in order to make a quantitative and qualitative assessment of the conditions under which shipments switch from sea to sea-air or air.

Model Case Study No. 1 - low density/medium value shipment

Product:	*Readymade garments*
Origin:	*Taiwan*
Destination:	*Frankfurt*
Monetary Unit:	*US Dollars*
Chargeable weight unit:	*Kilos/tonnes/cubic metres*
Volume and weight:	*11.5 cbm/1,306 kgs.*
FOB value (US$) :	*18.38/kg (US$ 24,000 ÷ 1,306 kgs)*

A. Inputs

	Mode of transport	Sea	Air	Sea-air
1.	As per letter of credit: credit line (days)	90	30	45
2.	Average ex factory to consignee's door transit time (days)	33	5	17
3.	Maximum ex factory to consignee's door transit time (days)	35	6	18
4.	Minimum ex factory to consignee's door transit time (days)	31	4	16
5.	Net weight (kgs)	1,208	1,208	1,208
6.	Packaging weight	98	98	98
7.	Gross deadweight (kgs)	1,306	1,306	1,306
8.	Shipment volume (cbm)	11.5	11.5	11.5
9.	Gross chargeable volume weight (kgs)	11,500	1,916	1,916
10.	Freight rate per kg (US$)[1]	0.18	2.70	1.70
11.	Packaging cost (US$)[2]	0.20	0.20	0.20
12.	Freight Forwarder's cost pick up ex factory to FOB (US$) (Free on Board ready for carriage)	0.20	0.20	0.20
13.	Insurance cost %	0.5	0.2	0.3
14.	Warehousing and stockpiling cost	0.16	0.04	0.04
15.	Average interest on credit line and capital tied up % p.a.	12.0%	12.0%	12.0%
16.	Duty type CIF & rate %	12.0%	12.0%	12.0%

	Total distribution cost (US$)	Sea	Air	Sea-air
1.	Ex factory value including warehousing and insurance costs	24,000	24,000	24,000
2.	Packaging cost at origin	261	261	261
3.	Ex factory to ready for carriage cost	270	270	270
4.	FOB Value	24,531	24,531	24,531
5.	Freightage - export gateway to import gateway - port to port or airport	2,070	5,173	3,257
6.	Custom clearances, pick-ups & deliveries ex factory to consignee's door[3]	1,091	436	655
7.	Insurance, port of origin to consignee's door[4]	135	54	81
8.	Warehousing and stockpiling at destination	200	50	50
9.	Interest on capital tied up at an average 12% p.a.	840	336	504
10.	CIF value (cost/insurance/freight)	28,867	30,580	29,078
11.	Duty rate of 12% on CIF values	3,464	3,669	3,489
12.	Total distribution cost (total product cost plus delivery, less factory value)	8,331	10,249	8,567
13.	Total product cost plus delivery to consignee's warehouse.	**32,331**	**34,249**	**32,567**
14.	% increase/decrease over direct ocean.	-	+ 5.9%	+ 0.7%

1. Freight rate per kg: Air freight rates are quoted airport to airport. Sea freight rates are quoted port to port, and sea-air rates are quoted to include break bulk and build up of pallets for air lift. Air freight rates from a transfer hub are quoted to apply for any air shipment, and no special consideration is given to a sea-air shipment.
2. Packaging cost: It is the same under the three modes, since the same packing method is used for air or sea freight in containers. Bulk shipping packaging is excluded as it does not apply today.
3. Under all ocean & pure air freight modes, figures include costs of 2 customs clearances & pick-ups & deliveries, once at origin and once at destination, while under the sea-air mode, a third is included, that of 'inbond' customs clearance and deliveries from ports to airport at a transfer hub.
4. Insurance: Insurance companies calculate full risks coverage premiums by adding 10% to FOB value for freightage and delivery to consignee's door and apply their % rates on the total.

The important factors in this case study, and those that follow, are the variable factors, shown under 'Inputs', governing the total distribution cost.

A. Input

1. Freightage: the chargeable weight and rate under each mode.
2. Warehousing and stockpiling at destination.
3. Door to door insurance.
4. Interest on capital tied up/credit line.

B. Output

1. Total delivered value of product in relation to total distribution cost of each mode.
2. Convertibility from the ocean mode to the sea-air and air modes by considering total delivered costs of each as a percentage increase or decrease over or below that of the ocean mode.

A. Inputs:

Freightage is the most important factor in the build up of the total distribution cost. The charge in ocean transport is 1cbm = 1 tonne (1,000 kgs), whichever is greater. The measurement weight in this case study is 11.5 cbm, which is higher than the dead weight of 1,306 kgs, or 1.3 tonnes. Therefore, 11.5 cbm are charged at US$ 180.00 per cbm, from Kaochung port in Taiwan to Frankfurt, via the port of Hamburg (inclusive of overland trucking to Frankfurt), as quoted by Maersk Lines in August 1994, equals 11.5 x 180.00 = US$ 2,070.00. In order to have a meaningful comparison of the chargeable weights of the three modes of transport, the shipping lines' quote per tonne or cbm is converted to a quote per kilogramme by dividing the rate of US$ 180.00 per tonne or cbm, by 1,000 kgs, yielding a rate of US$ 0.18 per kg, which is applied throughout all the case studies.

In air freight, 6 cbm = 1,000 kgs or 1 tonne, which means (11.5 ÷ 6) = 1,916 kgs x US$ 2.70/kg (quoted by Air China in 1994) = US$ 5,173.00 for direct air freight. This rate is applied for all the case studies that follow.

The charge under sea-air is a combination of the two modes' chargeable measurement of volume to weight ratios. A quote per kg is derived based on the air freight ratio for the second segment of the journey, as follows:

1. The ocean transport charge of 11.5 cbms is charged for the first segment of the journey - Maersk Lines quoted in August 1994 for the ocean sector Taipei/Dubai, US$ 80.00 per cbm. Therefore, 11.5 cbm x US$ 80.00 = US$ 920.00.
2. The air freight charge of (11.5 ÷ 6) = 1,916 kgs for the second segment of the journey, i.e. the air freight rate (as quoted by Lufthansa in August 1994) of US$ 1.22/kg, for the sector Dubai/Frankfurt, was 1,916 kgs x US$ 1.22 = US$ 2,337.00. It is worth mentioning here that rates quoted by Maersk and Lufthansa are commisionable to the forwarder.
3. Combining both charges, US$ 2,337 + US$ 920.00 = the total

sea-air charge of US$ 3,257.00. To construct a single through sea-air rate, the total sea-air charges of US$ 3,257 are divided by 1,916 kgs (the chargeable weight under the air freight ratio of 6:1) yielding the sea-air rate of US$ 1.70, as quoted by the consolidator in Taiwan. This sea-air rate is quoted throughout the case studies that follow.

The innovative introduction of a single through sea-air rate, constructed as per the method shown above, was initiated by the freight forwarder (sea-air operator) in the early 1980s in an attempt to eliminate the possibility of confusing shippers and consignees with a multiplicity of rates covering each mode of transport used in the sea-air journey of a shipment to its final destination. It started as a convenience, and later developed into a fundamental characteristic of the sea-air operator, and that is; his ability to quote a single through rate and issue a 'Combined Transport Document' (CTD) covering all modes of transport, used from port of origin to airport of destination, or ex works at origin to consignee's door.

Stockpiling and warehousing, in the case of all-ocean, is costly because of the nature of container handling, and the fact that all incoming containers must first be moved from the entry port to the central container terminal for break-bulking and customs clearance before delivery to consignee's warehouse. This operation is time consuming and costly when compared to the arrival of shipments by air to the entry gateway airport, where customs clearance is done within the hour, or prior to arrival, and shipments are carried from the airport and distributed to consignee outlets within the country. Sea-air shipments enjoy this quality as the second segment of the journey is air, and what is applicable to direct air freight is also applicable to sea-air. Air freight shipments are urgent shipments, and are not meant to undergo warehousing, stockpiling, inventory tracing, etc. In addition, the recurrence of air freight shipments is much higher than that of ocean. Therefore, the number of air shipments 'passing through' the destination warehouse to the end users is much greater and, hence, the average cost per 'stay time' at the warehouse is lower, per shipment, than that for ocean. The air/ocean stockpiling cost ratio is 4:1, i.e ocean stockpiling costs are four times as much as air, on average.

Insurance coverage rates, applicable to FOB value, vary from 0.2% to 0.3% to 0.5%, depending on the mode of transport used. In ocean, the B/L maximum liability, in case of loss and damage, partial or total, is limited by the Hague-Visby Rules and the Brussels Protocol of 1968 to a maximum of 2 SDR (Special Drawing Rights) which is equivalent to US$ 2.00/kg. Such a low liability limit forces the shipper and consignee to seek additional insurance as per FOB value, and therefore a higher insurance premium is levied on declared value in excess of US$ 2.00 per kg.

In air freight, the airline's maximum liability, as set by the Warsaw Convention, is not to exceed US$ 20.00 per kg, covering damage and loss, partial or total, including excessive delays.

Since this is considered to be a sufficient cover, no additional insurance coverage is required unless the value of the shipment exceeds the US$ 20.00 per kg. Then the value is declared on the Air Waybill and a premium is levied on the excess value declared.

In sea-air, additional coverage is required to cover the ocean segment of the journey. Further, freight forwarders provide a blanket coverage to their pick-up and delivery activities, whether at export centres at origin ex factory to 'ready for carriage' delivery at carrier's export gateways' receiving bays, or at sea-air transfer ports from the time they collect shipments from shipping line container terminals to the time of delivery to the airline, or at airports of final destination, from the time they collect shipments to delivery time at the consignee's door.

Freight forwarders construct their rates and charges to include the premium of the blanket insurance and, therefore, no premium is charged separately to shippers and consignees. Despite the adequate airline coverage, shippers and consignees seek additional insurance from specialised brokers or insurance institutions. These brokers and insurers are fully aware of the airline coverage and therefore apply a much lower rate on air freight of 0.2% and slightly higher on sea-air at 0.3% and 0.5% on all-ocean.

As for interest, the consignee opens a letter of credit (L/C) through his bank in favour of the shipper. The L/C specifies a date of order delivery to the carrier who issues an Air Waybill (AWB) in case of direct air or a Bill of Lading (B/L) in case of direct ocean and a Combined Transport Document (CTD) in case of sea-air, on receipt of the ordered shipment. The shipper negotiates the L/C with the consignee's bank correspondent in his country and submits the required originals of the carrier transport documents, invoices and packing lists and cashes the CIF value of the goods. From the date of payment to the shipper, the bank extends a credit line to the consignee (at an averaged interest rate of 12% pa) for settlement that varies with the mode of transport used; 30 days for air freight, 45 days for sea-air and 90 days for all-ocean.

The total delivered value of the shipment, including duties, becomes quite important to the consignee when related to the total distribution costs ex factory to consignee's door.

Ocean total distribution costs of US$ 8,331.00 represents 25.8% of total delivered value.
Sea-air total distribution costs of US$ 8,567.00 represents 26.3% of total delivered value.
Air total distribution costs of US$ 10,249.00 represents 29.9% of total delivered value.

Immediately, the convertibility of ocean freight to sea-air is clearly seen, as the sea-air mode transport total delivered costs, differs by a fraction of a percentage point, 0.7%, higher than that of all-ocean. Further, the sea-air mode offers a number of advantages over all ocean mode, namely:

1. Transit time is cut by almost 50% (17 days vs. 33 days)
2. Arrival of the shipment into the airport nearest to the consignee, rather than into the port most convenient to the shipping lines.
3. Faster and much less costly customs clearances and deliveries from airports as against sea ports.

These advantages constitute important considerations to the final consignee who is concerned to supply the goods to the market place as soon as possible. The faster the goods are sold, faster is the capital replenished. On the other hand, convertibility to direct air becomes also possible when the speed of delivery (5 days vs. 33 days) is considered against the percentage increase in total delivered product value of only 5.9% over that of ocean. In conclusion, low density products, having medium value, are readily convertible from the ocean mode to the sea-air mode as the difference between the two modes' total distribution cost is negligible, while conversion to the direct air mode depends on whether the speed of delivery is essential to the consignee and justifies an increase of total delivered cost of 5.9%.

<u>Model Case Study No. 2</u> - low density/high value shipment
15 cbm/1,200 kgs. FOB Value: US$ 34.00/kg.

Product:	*Toys*
Origin:	*Hong Kong*
Destination:	*Frankfurt*
Monetary Unit:	*US Dollars*
Chargeable weight unit:	*Kilos/tonnes/cubic metres*

	Mode of transport	**Sea**	**Air**	**Sea-air**
1.	As per letter of credit: credit line (days)	90	30	45
2.	Average ex factory to consignee's door transit time (days)	33	5	17
7.	Gross deadweight (kgs)	1200	1200	1200
8.	Shipment volume (cbm)	15	15	15
9.	Gross chargeable volume weight (kgs)	15,000	2,500	2,500
10.	Freight rate per kg (US$)	0.18	2.70	1.70
	Total distribution cost (US$)	**Sea**	**Air**	**Sea-air**
1.	Ex factory value including warehousing and insurance costs	40,000	40,000	40,000
2.	Packaging cost at origin	400	400	400
3.	Ex factory to ready for carriage cost	400	400	400
4.	FOB Value	40,800	40,800	40,800
5.	Freightage - export gateway to import gateway - port to port or airport	2,700	6,750	4,250
6.	Customs clearances, pick-ups & deliveries ex factory to consignee's door	1,815	726	1,089
7.	Insurance, port of origin to consignee's door	225	90	135
8.	Warehousing and stockpiling at destination	280	70	70
9.	Interest on capital tied up at an average 12% p.a.	1,224	490	734
10.	CIF value (cost/insurance/freight)	47,044	48,926	47,078
11.	Duty rate of 12% on CIF values	5,645	5,871	5,649
12.	Total distribution cost	12,689	14,797	12,727
13.	Total product cost plus delivery to consignee's warehouse.	52,689	54,797	52,727
14.	% increase/decrease over direct ocean.	-	+ 4.0%	+ 0.07%

In this model, the high value of the shipment is highlighted, while its low density is similar to that in Model case No. 1. The impact of high value products is seen when total distribution cost is related to the total value of the delivered shipment.
Ocean total distribution cost of US$ 12,689.00 represent 24.0% of the total cost of the delivered product.
Sea-air total distribution costs of US$ 12,727.00 represents 24.1% of the total cost of the delivered product.
Air total distribution cost of US$ 14,797.00 represent 27.0% of the total cost of the delivered product.

The convertibility from the ocean mode to the sea-air mode is inevitable as the difference is only 0.07% between them, in relation to the total value of the delivered product. While the convertibility from the ocean mode to the direct air mode can be termed as acceptable because the difference in total delivered costs of the two modes of only 4% should be outweighed by the speed of air delivery. In conclusion; the higher the value of low density cargo, the lower is the difference in the total distribution cost, in relation to the delivered product value of the three modes, especially that of sea-air.

<u>Model Case Study No. 3</u> - medium density/high value shipment 6 cbm/1,200 kgs. FOB Value: US$ 42.17/kg.

Product: *Imitation Jewellery*
Origin: *Hong Kong*
Destination: *Frankfurt*
Monetary Unit: *US Dollars*
Chargeable weight unit: *Kilos/tonnes/cubic metres*

	Mode of transport	**Sea**	**Air**	**Sea-air**
1.	As per letter of credit: credit line (days)	90	30	45
2.	Average ex factory to consignee's door transit time (days)	33	5	17
7.	Gross deadweight (kgs)	1200	1200	1200
8.	Shipment volume (cbm)	6	6	6
9.	Gross chargeable volume weight (kgs)	6,000	1,200	1,200
10.	Freight rate per kg (US$)	0.18	2.70	1.70
	Total distribution cost (US$)	**Sea**	**Air**	**Sea-air**
1.	Ex factory value including warehousing and insurance costs	50,000	50,000	50,000
2.	Packaging cost at origin	300	300	300
3.	Ex factory to ready for carriage cost	300	300	300
4.	FOB Value	50,600	50,600	50,600
5.	Freightage - export gateway to import gateway - port to port or airport	1,080	3,240	2,040
6.	Customs clearances, pick-ups & deliveries ex factory to consignee's door	2,250	900	1,350
7.	Insurance, port of origin to consignee's door	280	112	168
8.	Warehousing/stockpiling at destination	280	70	70
9.	Interest on capital tied up at 12% p.a.	1,518	607	910
10.	CIF value (cost/insurance/freight)	56,008	55,529	55,138
11.	Duty rate of 12% on CIF values	6,720	6,663	6,616
12.	Total distribution cost	12,728	12,192	11,754
13.	Total product cost plus delivery to consignee's warehouse.	**62,728**	**62,192**	**61,754**
14.	% increase/decrease over direct ocean.	-	- 1.0%	- 1.6%

In this model, the density and the value of the shipment is highlighted. The impact of both is as follows:

Ocean total distribution cost of US$ 12,728.00 represent 20.3% of the total cost of the delivered product.
Sea-air total distribution costs of US$ 11,754.00 represent 19.0% of the total cost of the delivered product.
Air total distribution costs of US$ 12,192.00 represent 19.6% of the total cost of the delivered product.

The convertibility from the ocean mode to the air and sea-air mode is clearly seen as inevitable because both result in lower than ocean total cost of the delivered product. Air is lower by 1.0% and sea-air by 1.6%.

In conclusion; the higher the value of medium density cargo, the higher is the ocean mode total cost of delivered product vis-a-vis the sea-air and direct air totals. This is a case where the sea-air and direct air modes are less costly than the ocean mode.

<u>Model Case Study No. 4</u> - high density/low value shipment
3 cbm/1,200 kgs. FOB Value: US$ 4.00/kg.

Product:		*Metal spare parts*			
Origin:		*Hong Kong*			
Destination:		*Frankfurt*			
Monetary Unit:		*US Dollars*			
Chargeable weight unit:		*Kilos/tonnes/cubic metres*			
	Mode of transport		**Sea**	**Air**	**Sea-air**
1.	As per letter of credit: credit line (days)		90	30	45
2.	Average ex factory to consignee's door transit time (days)		33	5	17
7.	Gross deadweight (kgs)		1200	1200	1200
8.	Shipment volume (cbm)		3	3	3
9.	Gross chargeable volume weight (kgs)		3,000	1,200	1,200
10.	Freight rate per kg (US$)		0.18	2.70	1.70
	Total distribution cost (US$)		**Sea**	**Air**	**Sea-air**
1.	Ex factory value including warehousing and insurance costs		4,000	4,000	4,000
2.	Packaging cost at origin		400	400	400
3.	Ex factory to ready for carriage cost		400	400	400
4.	FOB Value		4,800	4,800	4,800
5.	Freightage - export gateway to import gateway - port to port or airport		540	3,240	2,040
6.	Customs clearances, pick-ups & deliveries ex factory to consignee's door		214	85	128
7.	Insurance, port of origin to consignee's door		26	11	16
8.	Warehousing and stockpiling at destination		96	24	24
9.	Interest on capital tied up at an average 12% p.a.		144	48	72
10.	CIF value (cost/insurance/freight)		5,820	8,208	7,008
11.	Duty rate of 12% on CIF values		698	985	840
12.	Total distribution cost		2,518	5,193	3,848
13.	Total product cost plus delivery to consignee's warehouse		**6,518**	**9,193**	**7,848**
14.	% increase/decrease over direct ocean.		-	+ 41.0%	+ 20.4 %

In model case No. 4, the density of the shipment is high and its value is low. The impact of high density and low value is as follows:

Ocean total distribution cost of US$ 2,518.00 represent 38.6% of the total cost of the delivered product.
Sea-air total distribution costs of US$ 3,848.00 represent 49.0% of the total cost of the delivered product.
Air total distribution cost of US$ 5,193.00 represent 56.5% of the total cost of the delivered product.
This is a case where the conversion of all ocean to other modes is very costly. Both direct air and sea-air total delivered costs are 41.0% and 20.4% higher than that of ocean, respectively.

In conclusion; the lower the value of high density cargo, the higher are the differences in the total distribution costs among the three modes, with a much lower ocean mode total cost of delivered product vis-á-vis the sea-air and direct air modes. Convertibility becomes much less viable, and, therefore, the all ocean mode assumes dominance.

Model Case Study No. 5 - high density/medium value shipment
4 cbm/1,200 kgs. FOB Value: US$ 8.00/kg.

Product: *Electronic spares and tools*
Origin: *Hong Kong*
Destination: *London*
Monetary Unit: *US Dollars*
Chargeable weight unit: *Kilos/tonnes/cubic metres*

	Mode of transport	**Sea**	**Air**	**Sea-air**
1.	As per letter of credit: credit line (days)	90	30	45
2.	Average ex factory to consignee's door transit time (days)	33	5	17
7.	Gross deadweight (kgs)	1200	1200	1200
8.	Shipment volume (cbm)	4	4	4
9.	Gross chargeable volume weight (kgs)	4,000	1,200	1,200
10.	Freight rate per kg (US$)	0.18	2.70	1.70
	Total distribution cost (US$)	**Sea**	**Air**	**Sea-air**
1.	Ex factory value including warehousing and insurance costs	9,000	9,000	9,000
2.	Packaging cost at origin	300	300	300
3.	Ex factory to ready for carriage cost	300	300	300
4.	FOB Value	9,600	9,600	9,600
5.	Freightage - export gateway to import gateway - port to port or airport	720	3,240	2,040
6.	Customs clearances, pick-ups & deliveries ex factory to consignee's door	427	171	256
7.	Insurance, port of origin to consignee's door	53	21	32
8.	Warehousing and stockpiling at destination	128	32	32
9.	Interest on capital tied up at an average 12% p.a.	288	96	144
10.	CIF value (cost/insurance/freight)	11,216	13,160	12,104
11.	Duty rate of 12% on CIF values	1,345	1,579	1,452
12.	Total distribution cost	3,561	5,739	4,556
13.	Total product cost plus delivery to consignee's warehouse.	**12,561**	**14,739**	**13,556**
14.	% increase/decrease over direct ocean.	-	+ 17.3%	+ 7.9%

Model case No. 5 highlights high density and medium value. The impact of both is as follows:

Ocean total distribution cost of US$ 3,561.00 represent 28.3% of the total cost of the delivered product.
Sea-air total distribution costs of US$ 4,556.00 represent 33.6% of the total cost of the delivered product.
Air total distribution cost of US$ 5,739.00 represent 38.9% of the total cost of the delivered product.

Again, the lower the value of high density cargo, the higher the difference in costs among the three modes of transport. The lowest total cost, whether that of distribution or delivered product, is clearly shown in the ocean mode, and, therefore, the convertibility from the ocean mode to the air or sea-air mode is subject to careful considerations of the conclusions and advantages listed under Model Case No. 1, as the difference between the ocean mode total delivered cost, in relation to that of sea-air, is 7.9%, and 17.3% over that of air freight - a relatively high percentage when considering the per kg FOB value of the product. Adding the sea-air 7.9% to the total delivered product value means an increase of over 10.0% on the product FOB value or US$ 0.83 per kg (sea-air total distribution cost of US$ 4,556.00 less ocean total distribution cost of US$ 3,561.00 = US$ 995.00, divided by 1,200 kgs, the weight of the shipment = US$ 0.83 per kg increase in FOB value), a cost which may not be competitive in the market place and, therefore, the end user may be quite reluctant to convert to the sea-air mode. The direct air freight mode is ruled out as the increase in total delivered cost is very high at 17.3%, to consider conversion.

Model Case Study No. 6 - high density/high value shipment
3 cbm/1,200 kgs. FOB Value: US$ 22.00/kg.

Product: *Electronic generators and engines*
Origin: *Hong Kong*
Destination: *London*
Monetary Unit: *US Dollars*
Chargeable weight unit: *Kilos/tonnes/cubic metres*

	Mode of transport	Sea	Air	Sea-air
1.	As per letter of credit: credit line (days)	90	30	45
2.	Average ex factory to consignee's door transit time (days)	33	5	17
7.	Gross deadweight (kgs)	1200	1200	1200
8.	Shipment volume (cbm)	3	3	3
9.	Gross chargeable volume weight (kgs)	3,000	1,200	1,200
10.	Freight rate per kg (US$)	0.18	2.70	1.70
	Total distribution cost (US$)	**Sea**	**Air**	**Sea-air**
1.	Ex factory value including warehousing and insurance costs	26,000	26,000	26,000
2.	Packaging cost at origin	200	200	200
3.	Ex factory to ready for carriage cost	200	200	200
4.	FOB Value	26,400	26,400	26,400
5.	Freightage - export gateway to import gateway - port to port or airport	540	3,240	2,040
6.	Customs clearances, pick-ups & deliveries ex factory to consignee's door	1,175	470	705
7.	Insurance, port of origin to consignee's door	145	58	87
8.	Warehousing and stockpiling at destination	216	54	54
9.	Interest on capital tied up at an average 12% p.a.	792	264	396
10.	CIF value (cost/insurance/freight)	29,268	30,486	29,682
11.	Duty rate of 12% on CIF values	3,512	3,658	3,561
12.	Total distribution cost	6,780	8,144	7,243
13.	Total product cost plus delivery to consignee's warehouse.	**32,780**	**34,144**	**33,243**
14.	% increase/decrease over direct ocean.	-	+ 4.2%	+ 1.4%

Model case No. 6, represents the counterpart of Model Case No. 1. Here the density is high instead of low and the value is high instead of medium. The impact of high value reduces the negation of high density cargo to convertibility.

Ocean total distribution costs of US$ 6,780.00 reflect 20.7% of the total cost of the delivered product.
Sea-air total distribution costs of US$ 7,243.00 reflect 21.8% of the total cost of the delivered product.
Air total distribution cost of US$ 8,144.00 reflect 23.8% of the total cost of the delivered product.

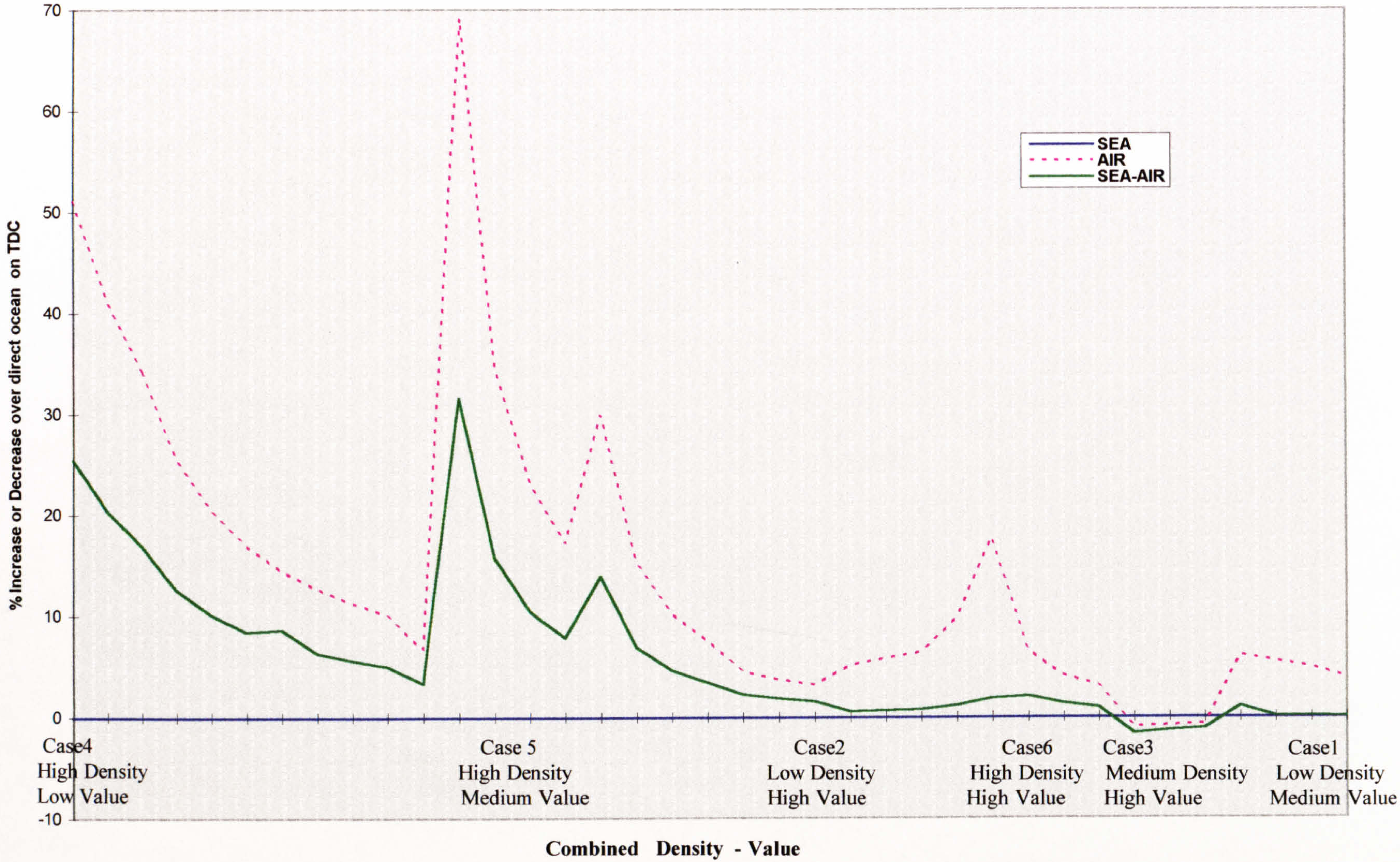
High value shipments reduce the differences in total costs of distribution and delivery among the three modes of transport, and therefore enhance the possibilities of convertibility from the ocean mode to the sea-air and direct air mode. The differences between ocean total costs of delivery, in relation to that of sea-air is 1.4%, and 4.2% in the case of direct air. Both differences can be positively considered in the light of the advantages and conclusions cited under Case No. 1, especially the speed of delivery.

In summary, the conclusions of the six model cases, as depicted on the following page, demonstrate that:

The higher the value of medium to low density cargo, the lower are the differences in the total costs of distribution and delivery among the three modes, and, therefore, the convertibility from the ocean mode to the sea-air or direct air mode is easier.

The lower the value of medium to high density cargo, the greater are the differences in total cost of distribution and delivery among the three modes, and, therefore, the convertibility from the ocean mode to the sea-air or direct air mode is much less viable.

Figure 22 : % INCREASE OR DECREASE OVER DIRECT OCEAN ON TOTAL DELIVERED PRODUCT COST (TDC)
(DENSITY - VALUE COMBINED EFFECT)



Chapter 11

Conclusions

This study has established, for the first time, the importance and role of the sea-air mode in international trade, previously underestimated, and now growing rapidly.

Sea-air started attracting its traffic from pure ocean freight in the early 1980s with only a trickle of cargo. By 1994 the total sea-air volume for that year, uplifted by air from the six world major sea-air hubs of Miami, Seattle, Los Angeles, Singapore, Vancouver and the U.A.E. was as follows:

Miami:	256,000 tonnes
Seattle:	57,000 tonnes
Los Angeles:	100,000 tonnes
Singapore/Vancouver:	15,000 tonnes
U.A.E.	25,000 tonnes
Total	453,000 tonnes

As the sea-air mode assumes the role of direct air at transfer hubs, it becomes, therefore, an important factor in the present and future development of the air freight industry. Its current contribution is shown through its ability to convert 453 thousand tonnes from the ocean mode to the direct air freight mode, thus generating new and additional revenues to the airline industry (computed at an average of US$ 1.10/kg in 1994) of approximately US$ 500 million. In 1994, the Freight Load Factor reached 55.5% (Table 5, page 18) of the total available world scheduled international air cargo capacities as compared to 51.1% in 1982.

Control over the cargo flow already lost to the freight forwarder, became crucial to the airline industry in order to maintain their clientele. In previous chapters, attempts were made to identify measures adopted by the airline industry to regain control over the air cargo flow and its clientele (Chapter 3). The airline industry was forced to modify and extend its role from the air carriage of cargo from one airport to another, to the total distribution of cargo flow ex factory to consignee's door, thus becoming fully involved in the total logistics chain of air cargo through the use of other means of transport, besides aircraft, such as trucks and railways. In short, they became involved with intermodality.

Many major world airlines operate their own trucking system from/to their air gateway hubs in all six regions of the world, and directly interface with shippers and consignees. Further, a great number of airlines use the services of their country's railway system for pick up and delivery of air consignments from/to their major airport cargo hub, such as US air carriers, the Canadians, the Japanese and, to a lesser extent, the Europeans.

The airline industry has succeeded in penetrating deep into the air-land intermodality which was the exclusive domain of the freight forwarders and the NVOCCs (Non Vessel Owning Common Carriers). Competition continues in full force between the airlines and the freight forwarders over the control of air cargo flow and its clientele[1].

However, while the airline industry successfully penetrated the air-land intermodality, it has so far been unable to prevail on sea-air which remains exclusively under the control of the freight forwarder and the NVOCCs, simply because the ocean sector of the sea-air mode, operated by many major shipping lines. provides numerous frequencies and rate alternatives that the airlines cannot provide.

This study has further analysed the economic characteristics and operational patterns of this particular logistic chain by detailed examination of the major transfer hubs and sea-air flows. The key common factors are:

1. The general pattern of international trade between the Asia Pacific region and Europe, the Americas and Canada takes the form largely of a single direction, as does the sea-air cargo traffic flow from the markets of supply in the Asia Pacific region to the markets of demand in Europe, South and Central America. However, to North America and Canada, the cargo flow remains in a single direction, but via sea-land intermodality. Incoming cargoes to gateway ports, of North America and Canada, are further carried inland through efficient railways and trucking systems.

2. Sea-air hubs flourish around:

    a. A terminator port of high volume, high frequency shipping lines, located about halfway between the Asia Pacific region's gateway ports and those of Europe and the Americas, which is also an intermediary port cutting half the ocean transit time between the markets of supply of the Asia Pacific and the markets of demand of Europe and the Americas.
    b. A freely competitive market that allows the interplay of supply and demand to determine, among other things the level of transport costs.
    c. A 'free of restriction' government policy offering open skies to world air carriers and free entries to the market place by world transport operators.

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1. An excerpt from a circular by 'Expeditors International' a North American forwarder to his worldwide network citing KLM's direct contact with shippers and consignees, and threatening to counter attack. Quote:
"it seems that KLM came out in the open and declared their intention that they will be dealing direct with the shipper. Mr. Jacques Ancher, Executive Vice President and head of KLM Cargo was quoted: 'The customer is demanding this. More and more they want to talk to carriers like us. They need a meaningful dialogue so that the way we work together reflects the tremendous changes their own industries are going through'. Mr. Ancher stresses. 'The problem today is that the forwarder can be the customer or the intermediary or even the competitor, or all three', he added. It is unfortunate that he sees us as competitors, and is willing to knock on our customers door directly. We are sure that KLM is not even equipped to be a Global Logistics Provider, but if this is their choice to reward their customers (the Forwarders/Logistics Providers) we surely will have our own plans to counter attack that."
Unquote.

d. A market characterised by the availability of skilled labour and vast areas of land around gateway ports and airports for use by carriers and transport operators at moderate costs.

Future growth depends on developments of world trade and more especially on the interplay of commodity value, density, as well as transit time and total distribution costs.

The combined sea-air mode is attracting larger portions from the ocean mode of transport as seen in the six case studies examined. They prove that, in the light of the total cost distribution concept, high value and medium to low density cargo can be converted to the air freight mode if the speed of the delivery becomes paramount. The same portions of cargo are readily and easily convertible to the sea-air mode, as the total distribution costs of both are almost the same. Moreover, sea-air offers numerous added advantages, such as cutting the ocean delivery time by almost 50% and, therefore, replenishing capital much faster than through the ocean mode, at virtually no extra costs.

Therefore, in decision making, the choice of a transport mode becomes a function of the total distribution cost, commodity value and transit time (see Figure 22 on page 236).

1. The total distribution cost is a function of the mode of transport and the density of the consignment (the ratio of its volumetric measurement in relation to its gross weight).

2. The lower the density of a shipment, the lesser are the differences in total distribution costs among the three modes of transport. In this case, the choice of mode becomes a function of shipment density and transit time.

3. The higher the density of a shipment, the much wider are the differences in total distribution costs of the three modes. The choice of a mode becomes a function of total distribution cost and transit time.

4. The higher the commodity value of the shipment, the lesser are the differences in total distribution costs, among the three modes of transport, and they become a small fraction of its value at destination. The choice of a mode becomes a factor of commodity value and transit time.

5. The lower the commodity value of the shipment, the higher are the differences in total distribution costs, among the three modes of transport, and the higher is the consideration of the cost factor, as it may become a burden to the commodity value at the destination. It may inflate the value to such an extent that it renders it unsaleable to end users. The choice of a mode becomes a function of the total distribution cost and transit time.

In conclusion, the growth and development of sea-air cargo at transfer hubs opened the doors of the air freight industry to newcomers such as 'freight forwarders' becoming 'integrators', new, all-cargo specialist carriers and scheduled airlines operating additional cargo flights to and from airports of sea-air transfer hubs.

The impact of the newcomers was to stabilise the direct air freight cost from the transfer hub. Costs had risen drastically from the time of the '"fill in" unutilised capacities' rates of US$ 0.65 per kg, applicable to sea-air cargo on the sector Dubai/London in 1985 to US$ 1.10 per kg in 1995, for the same sector. This increase took place at all major sea-air hubs of the world for many reasons; the scarcity of air cargo space from Singapore, the suspension of Air Canada freighter services from Vancouver, the down-grading of Cargolux freighter services from Seattle, the emergence of huge air export of the ready-made garments industry in the U.A.E., competing with sea-air cargo for space, while Los Angeles and Miami followed the trend of higher air freight rates.

Sea-air cargo was able to, not only survive this hurdle and absorb the higher costs of air freight, but large portions were diverted to other nearby airports, searching for available cargo capacities at even much higher rates.

This was not an exceptional case. In the U.A.E., the increase in air freight costs started after the Gulf War and continued its gradual increase to reach US$ 1.25 in 1993, for the same sector Dubai/London. The same year witnessed the entry into the market by Air HongKong's twice weekly B747 freighters to Manchester and Brussels, which later increased to five weekly flights in 1994, Gulf Air's five B757 regular weekly freighter services to Brussels and the upgrading of Lufthansa Cargo flights to 17 per week from their new cargo hub at Sharjah International Airport. By the end of 1994, Lufthansa Cargo flights to and from Sharjah Airport grew to 45 per week (see Section 6.3 page 135). These developments were a stabilising factor which brought down the rates to US$ 1.10 per kg from 1994 onward (see Section 8.2.2, page 168).

Future trends and issues :

The future trends of sea-air intermodality depend largely on the development of trade links between the major economic blocs of the world, especially those of Asia-Pacific, Europe and the US, which are also the major manufacturing and consuming regions of the world. The trade patterns that will emerge from these developments will be an important factor in the development of the current sea-air hubs, the growth of some, the decline and disappearance of others and the emergence of new ones.

In Singapore, the air-to-air phenomenon is gradually replacing the sea-air mode at much higher costs. Singapore is a model sea-air hub having the infrastructure and all the requisite characteristics. In addition, it is characterised by a high degree of flexibility and elasticity. Its flexibility is shown by its ability to change roles within a very short period of time. In the case of sea-air cargo flow to Europe, the availability of air cargo space motivates sea-air originating from the surrounding Pacific Rim countries, while the scarcity of air cargo capacities motivates the air to air phenomenon from the same origin points at much higher costs than that of the sea-air mode, at more or less the same transit time of sea-air, because the 'air to air' mode involves 'waiting time' for air cargo space availability at Singapore Airport.

Therefore, the criteria of flexibility in the choice of a transport mode is determined solely by transit time. The shipper's objective is to deliver goods to end users 'in time'. Considerations of cost become important as the availability of air cargo space from Singapore becomes abundant and, therefore, the sea-air mode takes precedence as its transit time becomes similar to that of the 'air-to-air' mode when space was scarce.

The elasticity of Singapore Airport is manifested by the availability of options due mainly to its 'Open Skies' policy and, therefore, the presence of a multiplicity of scheduled and charter flights to destinations other than Europe and North America. The availability of high frequencies to New Zealand and Australia provide healthy grounds for the development and growth of sea-air cargo flow to these areas. 'Air to air' replaces sea-air when air cargo capacities become scarce. Sea-air regains its grounds as air cargo space becomes abundant. The temporary disappearance of the sea-air mode via Singapore, on the Europe/North America route, is compensated by its strong presence on the Australia/New Zealand route.

The U.A.E. is very similar to Singapore in its highly developed infrastructure and all other characteristics of a model sea-air transfer hub. It differs from Singapore by the availability of air cargo capacities at all times. However, the 'air-to-air' mode is virtually non-existent due to the absence of a highly developed air export trade from the U.A.E. and the surrounding states.

Other sea-air markets have emerged strongly during 1994:
The formation of the Commonwealth of Independent States 'CIS' comprises mainly landlocked states with very poor infrastructure and outdated overland road and rail links from the Black Sea ports to the densely populated cities inland. This had a positive impact on the sea-air mode via the U.A.E. ports in 1993 and 1994. Over sixteen charter airlines established their bases at Sharjah International Airport and operated a total of over a thousand flights per month to approximately 75 destinations in the CIS. Various types of cargo aircraft are used, ranging from the AN12, with a capacity of 12 tonnes, to the popular IL76 with a capacity of 40 tonnes to the huge AN 124 offering a capacity of 120 tonnes per flight.

Almost all flights took off, as per Sharjah Airport Authority records, at full cargo capacity. This development gave sea-air a boost in volumes and tonnage.

On the European route, sea-air volumes are forecasted to grow dramatically at a rate of 12% per annum to certain regions in Europe, such as the Scandinavian countries, Ireland, Scotland, Portugal, Spain, Southern France and the newly emerging democracies of Poland, Hungary, Czechoslovakia and Romania.

The factors behind this forecast are:

1. Direct ocean sailings from the Pacific Rim of the Far East to Ireland, Scotland and Finland are not dense, and consume an average of 28 - 35 days per sailing.

2. The gateway ports of some of those European countries are plagued by bureaucracy and red tape, especially those of Portugal and Spain.

3. Scandinavia, Finland and the ex-Eastern bloc countries are almost landlocked, and cargoes must undergo either an all-water trans-shipment at the gateway ports of Antwerp and Rotterdam, or an overland one. In both cases, all ocean transit time increase drastically.

In 1994, Lufthansa pioneered the first African Air Cargo hub for sea-air arriving at the U.A.E. ports. They initiated a once weekly DC8 freighter service from Sharjah to Nairobi, Kenya. Nairobi was declared a cargo hub by Lufthansa, and its African partner, Kenya Airways. This re-distribution centre was scheduled to provide a once weekly 15 tonnes capacity, B 727 freighter service to:

Entebbe - Uganda.
Lusaka - Zambia.
Bajoumbura - Burundi.
Kigali - Rwanda.
Dar Es Salaam - Tanzania.
Addis Ababa - Ethiopia.
Khartoum - Sudan.
Johannesburg - South Africa.

With the exception of Dar Es Salaam, all other cities are either landlocked, such as Entebbe, Lusaka, Bajoumbura and Kigali or have very slow overland connections from their own ports, such as Khartoum, Addis Abbaba and Johannesburg. Dar-Es-Salaam, itself a port, is not served regularly or directly by shipping lines of the Asia Pacific region, but served indirectly by Ned Llyod Shipping Line's once-monthly sailing via Bahrain with an ocean transit time of 20 days, and by feeder services from Aden, Djibouti and the U.A.E. ports. The feeders have very poor frequencies of one or two voyages every 45 days and cargo originating in the Pacific Rim countries may reach Dar Es Salaam in 65 to 70 days, or more.

The success of the Nairobi Cargo hub may induce other carriers to enter the market. Its failure will, however, force the operators to search for other options that would decrease total transport costs and total transit time of the sea-air journey. Most observers anticipate a partial failure of this route due to mainly two factors:

1. One weekly DC8 freighter is not enough to uplift the pile up of goods sitting at Sharjah Airport. Further, cargoes have to undergo a second week of waiting time for the next flight, thus equating sea-air transit time with that of all ocean.

2. At Nairobi Airport, an East African Airways 727 freighter operates only in cases of availability of a full load of 13 - 15 tonnes to any one destination. Two or more destinations cannot be served with one flight having a number of stopovers en route due mainly to the political unrest in many of the African countries and the lack of bilaterals.

The alternative could be the Port of Durban in South Africa, which is more convenient for this breakthrough. The voyage time of the shipping lines from the Pacific Rim ports to Durban could be equal to that of the U.A.E., and the heavy cost of the air lift from Sharjah to Nairobi could be replaced by a very low cost of overland connection from Durban to Johannesburg. From thereon, air-lift to many landlocked countries such as Uganda, Zambia, Rwanda, Burundi, etc. could be done at reasonable costs.

The current ocean routes connecting the Asia Pacific with Africa are constructed via Europe. Ocean freight is directed to the European ports of Antwerp, Rotterdam and Marseille, and then trans-shipped to shipping lines serving Africa's main ports. There are few direct sailings from the Pacific Rim countries to the main African ports of the Atlantic ocean.

The exceptions are the ports of South Africa, especially that of Durban, which fully qualifies to become a sea-air transfer hub, having six monthly direct and regular sailing frequencies from the Pacific Rim countries. There are many ports on the South and North African Coasts that may qualify to become a sea-air transfer hub, such as the ports of Abidjan (Ivory Coast), Lome (Togo), Free Town (Sierra Leone), Douala (Cameroun), Maputo (Benin), Conakry (Guinea), Port Harcourt (Nigeria), Dakar (Senegal), Liberville (Gabon) and Brazaville (Congo), all having an average of two direct sailing frequencies per month from the Pacific Rim.

The main gateway ports of the former French colonies of Dakar, Liberville, Abidjan, Conakry, Bamako, Bangui and Brazaville are either served direct or via the Port of Marseille by SAGA transport, a subsidiary of the French SAGA group.

It is premature to analyse their potential, as factors of political unrest, governmental bureaucracy, poor infrastructure and overland connections. In addition, the scarcity of regular flights from 'adjacent-to-port' airports, hinders any attempt to start a sea-air hub at these ports.

The air routes to Africa from the Pacific Rim countries are very rare, besides the few direct flights to Cairo and Addis Ababa, from different points in the Pacific Rim. Singapore provides the only regular and direct connection with the main cities of South Africa. Therefore, air cargo must first fly to a European airport for further connections on flights to the main African gateway airports. The transit time is acceptable and within a time frame of 6 - 8 days, but the cost of air freight is very high, at an average cost of US$ 7.00 per kg, as follows:

US$ 3.00/kg, for the first sector; Asia Pacific to Europe
US$ 4.00/kg, for the second sector; Europe to Africa

Sea-air via the U.A.E., using the Lufthansa/East African Airways hub at Nairobi, averages US$ 3.15 per kg, as follows::

US$ 0.40/kg for the ocean sector; Asia Pacific to U.A.E.
US$ 1.25/kg for the second segment; Sharjah/Nairobi (air)
US$ 1.50/kg for the third sector; Nairobi/final destination (air)

at an average transit time of 28 days versus 6 - 8 days for pure air freight via Europe.

Transit time and air costs could be cut at the port of Durban as a proposed alternative to the U.A.E. Ocean transit time remains the same, while air costs can be reduced by almost all the costs of the U.A.E./Nairobi segment, as it is replaced by the overland connection cost from Durban to Johannesburg. This ranges from US$ 0.10 - US$ 0.15 per kg. The total cost of sea-air via Durban could be as low as US$ 2.00 per kg. The cost breakdown is as follows:

US$ 0.40/kg for the ocean sector; Asia Pacific to Durban.
US$ 0.10/kg for the second segment; overland to Johannesburg
US$ 1.50/kg for the 3rd sector; Johannesburg/final destination (air).

The total transit time is also reduced to 20 days via Durban. Durban is poised, therefore, to assume the role of the first sea-air hub in Africa. With the removal of the apartheid regime, many world airlines, who refrained from operating to South Africa in the past, are now eager to establish bases at Johannesburg Airport.

With respect to Vladivostok, it is bound to disappear from the sea-air cargo scene due to the following factors:

1. Its port of Vostochny was served by a joint Japanese and Korean service of one shipping line which operated a once-weekly sailing from Japanese and Korean ports.

2. Russian governmental bureaucracy and red tape. In addition, the very poor infrastructure and overland connections to the airport of Vladivostok resulted in delays of 4 - 5 days between the port and airport.

3. The Russian government's subsidised fuel policy, which supplied the Russian Airlines, especially Aeroflot, with cheap fuel before 1993, was terminated. Aircraft fuel prices were subjected to open market forces and gradually equalled international price levels.

Because cheap, subsidised fuel was the prime reason that afforded Aeroflot the luxury of an empty leg return flight from Maastricht in Europe to Vladivostok via Moscow, the termination of the subsidy resulted in the eventual decline and disappearance of sea-air via Vladivostok, beginning in early 1993.

On the westerly route, Vancouver and Seattle will continue to act as gateway ports for the transfer of sea-air traffic to airports with ample cargo capacities, at the added costs of overland connections such as Toronto Airport in Canada and Atlanta and Miami in the U.S.A.

As far as San Francisco is concerned, sea-air cargo is most likely to grow and develop on the San-Francisco - Europe route as air cargo capacities are made available by the European carriers in addition to El Al, who are active in attracting this type of low return cargo. Growth on the route to South and Central America is very limited because air cargo capacities are provided largely by the American carriers who have no interest in sea-air cargo. The lack of interest is mainly due to the presence of high-return, domestic-made exports, and because of the limited capacity offered by the type of aircraft (B763 and B767) operating on this route.

South and Central American sea-air cargo will continue to be diverted to Los Angeles and Miami, and, therefore, limited growth is forecasted via San Francisco as a sea-air hub.

Los Angeles as a sea-air hub is active on two main routes. The route to Europe and the route to South and Central America.

Despite the introduction of new technology and fast container ships, the ocean journey from Japan, South Korea and Taiwan to Central and Northern Europe is still consuming an average of 30 to 35 days, because of the many ports of call en route.

The route to Europe is limited to the air cargo capacities made available by those airlines interested in sea-air cargo. The present imbalance of trade between Los Angeles air exports in relation to air imports to and from Europe makes it difficult for airlines to operate additional freighter services.

Increased freighter capacities cannot be economically justified through the dense carriage of air cargo on only one sector and especially when that cargo is largely sea-air and produces much lesser revenue to the airline concerned.

The only possibility for air cargo capacities to increase between Europe and Los Angeles lies in balancing the current directional imbalance of trade, i.e. by increased air imports into Los Angeles Airport, a case which is not likely to happen in the near future.

Therefore the possibilities of growth in sea-air cargo bound for Europe lies basically in the overland feeder services to alternative airports in the U.S.A, where air cargo capacities are available in abundance.

The route to South and Central America using ocean services, including the transfer of containers to South American shipping lines at Los Angeles or Miami, take an average of 45 days even to the present day in 1994. Direct ocean services from Europe and the Far East are comparatively very slow and unreliable (see page 246).

As well, direct air cargo capacity on regular flights from Europe and the Far East to Central and South America are very limited and very costly.

Given the 'just in time' market value of goods to the consignee, the bureaucratic delays in the final stages of delivery give more reason to the consignee to order the consignments from the shippers at origin, either by direct and costly air freight, or via the sea-air mode. The sea-air mode of transport is becoming largely the primary choice to Latin America and is practised via Miami and Los Angeles.

Miami is poised to become the biggest sea-air hub in the world. The factors supporting this statement are:

1. The availability of unlimited air cargo space to almost all gateways to South and Central America, in addition to Western Europe.

2. The presence of a great number of air carriers operating from/to Miami Airport providing the necessary dense flight frequencies and therefore a competitive rate structure which is bound to attract sea-air cargo.

3. The presence of a large Latin American population in the Florida area, that requires air imports of such products as fresh produce, cut flowers, foodstuffs, garments, souvenirs and other related items from their countries of origin, on daily basis. This factor provides air carriers with a marginal return leg revenue that offsets the imbalance of a unidirectional traffic.

4. The relatively long ocean transit time from the Asia-Pacific to South American countries located on the Southern Coast of

the Atlantic, such as Venezuela, Brazil and Argentina, that entails using of the Panama Canal. Equally long ocean transit time and fewer shipping line frequencies connect the Asia-Pacific with South American countries located on the Northern Coast of the Pacific Ocean, such as Ecuador, Peru and Chile.

5. The bureaucracy and red tape of South and Central American governments results in long delays at their gateway ports. Overland connections, whether by truck or rail are old and antiquated. The general infrastructure of the majority of the Latin American countries is very poor.

6. The awareness of Miami Airport Authorities,in 1992, of the importance of developing the Port and Airport of Miami as a transfer hub to South and Central America, and to points further inland within North America and Europe, prompted the construction of a US$ 500 million cargo facility programme.

All these factors add up to an exceptional sea-air cargo growth rate forecast of over 20% p.a. for the next 5 years, as of 1994.

With respect to the global sea-air cargo scene, world air cargo capacities will continue to be available and plentiful, because the 1994 freight load factor shows that over 40% of the available world air cargo capacity has not been utilised. With the new entries of freighter services into the markets of the sea-air hubs, additional fresh cargo capacities become available.

The future trend as forecasted by many major Asia-Pacific region forwarders is that of continuous growth of sea-air traffic at an average rate of 12% per annum[1], especially with the anticipated take over of Hong Kong by mainland China, in mid 1997. Hong Kong is expected to play a major role as an export gateway, in addition to the main Chinese ports of Shanghai and Xiamen. The prospects of Japan and South Korea continuing their sea-air cargo flow via North American ports, especially those of Los Angeles, Seattle and Miami are seen as experiencing a moderate growth rate of 8% per annum.

The high cost of skilled labour in Japan and South Korea has forced both to establish parallel industries in Indo-China, Malaysia, Thailand, Vietnam and China. Those industries are presumed to contribute an additional 18% per annum, on average, to the current global sea-air traffic via the U.A.E. for the European markets and via Los Angeles and Miami for South and Central American markets.

The gradual increase in sea-air rates and the high rate of growth of its traffic, are likely to produce an additional revenue of over 1 billion US Dollars to the airline industry per year, as of 1999.

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1. All forecasts are made by the Asia-Pacific region freight forwarders, and those of the Indian subcontinent (India, Pakistan, Bangladesh, Sri Lanka), and those of Thailand, Malaysia, Hong Kong, Indonesia and Taiwan, during interviews with them.

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J	Major World Ports: Analysis of container traffic.
K-1	World Airports (North American) highest percentage annual growth (1980 - 1994) split into three, 5 year periods; passengers, freight tonnes & A/C movements.
K-2	World Airports (Europe) highest percentage annual growth (1980 - 1994) split into three, 5 year periods; passengers, freight tonnes & A/C movements.
K-3	World Airports (Asia-Pacific) highest percentage annual growth (1980 - 1994) split into three, 5 year periods; passengers, freight tonnes & A/C movements.
K-4	World Airports (Latin America/Carribean) highest percentage annual growth (1980 - 1994) split into three, 5 year periods; passengers, freight tonnes & A/C movements.
K-5	World Airports (Africa) highest percentage annual growth (1980 - 1994) split into three, 5 year periods; passengers, freight tonnes & A/C movements.
K-6	World Airports (Middle East) highest percentage annual growth (1980 - 1994) split into three 5 year periods; passengers, freight tonnes & A/C movements.
L	Computation of the maximum net payload of an aircraft.

Appendix A.

Distribution by region of aircraft categories of world air transport fleet and percentage of regional share

	1969		1974		1979		1984		1989		1993[2]		1994[3]	
Region and aircraft type	No. of aircraft	% share of world total	No. of aircraft	% share of world total	No. of aircraft	% share of world total	No. of aircraft	% share of world total	No. of aircraft	% share of world total	No. of aircraft	% share of world total	No. of aircraft	% share of world total
Europe														
Wide bodied	--	0.0 %	110	21.9 %	237	25.4 %	350	23.5 %	470	24.0 %	650	22.6 %	710	22.9 %
Narrow bodied	845	24.5 %	1295	29.8 %	1400	27.9 %	1307	24.6 %	1568	23.8 %	2040	25.8 %	2135	25.7 %
Total	845	24.3 %	1405	29.0 %	1637	27.5 %	1657	24.4 %	2038	23.9 %	2690	25.0 %	2845	24.9 %
North America														
Wide bodied	16	100.0 %	311	61.8 %	424	45.5 %	570	38.3 %	745	38.1 %	1150	40.0 %	1230	39.6 %
Narrow bodied	2168	62.7 %	2147	49.4 %	2326	46.4 %	2622	49.3 %	3520	53.5 %	3970	50.2 %	4170	50.2 %
Total	2184	62.9 %	2458	50.7 %	2750	46.3 %	3192	46.9 %	4265	50.0 %	5120	47.5 %	5400	47.3 %
Asia & Pacific														
Wide bodied	---	0.0 %	62	12.3 %	186	20.0 %	320	21.5 %	460	23.5 %	733	25.5 %	805	25.9 %
Narrow bodied	180	5.2 %	333	7.7 %	454	9.1 %	400	7.5 %	410	6.2 %	517	6.5 %	549	6.6 %
Total	180	5.2 %	395	8.2 %	640	10.8 %	720	10.6 %	870	10.2 %	1250	11.6 %	1354	11.9 %
Middle East														
Wide bodied	--	0.0 %	7	1.4 %	43	4.6 %	110	7.4 %	135	6.9 %	180	6.3 %	190	6.1 %
Narrow bodied	62	1.8 %	121	2.8 %	193	3.9 %	195	3.7 %	215	3.3 %	270	3.4 %	284	3.4 %
Total	62	1.8 %	128	2.6 %	236	4.0 %	305	4.5 %	350	4.1 %	450	4.2 %	474	4.2 %
Latin America & Carribean														
Wide bodied	---	0.0 %	7	1.4 %	23	2.5 %	70	4.8 %	75	3.8 %	85	3.0 %	90	2.9 %
Narrow bodied	125	3.6 %	274	6.3 %	407	8.1 %	490	9.2 %	510	7.8 %	695	8.8 %	731	8.8 %
Total	125	3.6 %	281	5.8 %	430	7.2 %	560	8.2 %	585	6.9 %	780	7.2 %	821	7.2 %
Africa														
Wide bodied	--	0.0 %	6	1.2 %	19	2.0 %	67	4.5 %	70	3.6 %	75	2.6 %	80	2.6 %
Narrow bodied	76	2.2 %	174	4.0 %	231	4.6 %	303	5.7 %	352	5.4 %	415	5.2 %	440	5.3 %
Total	76	2.2 %	180	3.7 %	250	4.2 %	370	5.4 %	422	4.9 %	490	4.5 %	520	4.6 %
World all regions														
Wide bodied	16	100.0%	503	100.0%	932	100.0%	1487	100.0%	1955	100.0%	2873	100.0%	3105	100.0%
Narrow bodied	3456	100.0%	4344	100.0%	5011	100.0%	5317	100.0%	6575	100.0%	7907	100.0%	8309	100.0%
Total	3472	100.0%	4847	100.0%	5943	100.0%	6804	100.0%	8530	100.0%	10780	100.0%	11414	100.0%

Source: ICAO Circular 158-AT/57, 222 AT/90, Doc 9180/19, PIO 10/94.

1. *Includes CIS countries.*
2. *1993 figures are indicative to 1994 forecasted figures.*
3. *1994 figures as per ICAO statistic of new aircraft orders of 232 wide-bodied and 402 narrow-bodied aircraft.*

Appendix B:

Percentage share distribution of international air cargo capacity by region (1974 - 1994)

	1974	1979	1984	1989	1993[1]	1994[2]
Europe : Wide-bodied	19.6	22.7	21.0	21.5	20.2	20.5
Narrow-bodied	3.1	2.9	2.6	2.5	2.7	2.7
% share of total intl capacity	22.7%	25.6%	23.6%	24.0%	22.9%	23.2%
North America : Wide-bodied	55.4	40.8	34.3	34.1	35.8	35.5
Narrow-bodied	5.1	4.8	5.1	5.6	5.2	5.2
% share of total intl capacity	60.5%	45.6%	39.4%	39.7%	41.0%	40.7%
Asia Pacific : Wide-bodied	11.0	17.9	19.3	21.0	22.8	23.2
Narrow-bodied	0.7	0.9	0.8	0.8	0.9	0.8
% share of total intl capacity	11.7%	18.8%	20.1%	21.8%	23.7%	24.0%
Middle East : Wide-bodied	1.3	4.1	6.6	6.2	5.6	5.5
Narrow-bodied	0.3	0.4	0.4	0.3	0.4	0.3
% share of total intl capacity	1.6%	4.5%	7.0%	6.5%	6.0%	5.8%
Latin America : Wide-bodied	1.3	2.2	4.3	3.4	2.7	2.6
Narrow-bodied	0.7	1.0	1.0	0.8	0.9	0.9
% share of total intl capacity	2.0	3.2%	5.3%	4.2%	3.6%	3.5%
Africa : Wide-bodied	1.1	1.8	4.0	3.2	2.3	2.3
Narrow-bodied	0.4	0.5	0.6	0.6	0.5	0.5
% share of total intl capacity	1.5%	2.3%	4.6%	3.8%	2.8%	2.8%

Source: *Computed from figure 2, page 26 and Appendix 3.1 and our worksheets.*

1. *1993 figures are indicative for the year 1994.*
2. *1994 figures are estimated.*

Appendix C.

Percentage distribution of international scheduled air cargo traffic in million TKs performed by region and average annual growth rate

Region	Region's performance: annual growth rate				
	1969	1979	1989	1993*	1994**
Europe[1]					
International Freight TK Performed	2,930	7,955	16,620	19,050	20,380
% share of world international TKs	48.0%	42.1%	37.0%	34.3%	33.8%
Rate of annual growth	---	11.1%	7.7%	6.5%	7.0%
North America					
International Freight TK Performed	1,800	3,535	8,300	9,750	10,590
% share of world international TKs	29.5%	18.7%	18.5%	17.5%	17.6%
Rate of annual growth	---	6.7%	8.6%	7.0%	7.6%
Asia & Pacific					
International Freight TK Performed	630	4,330	14,100	20,150	22,265
% share of world international TKs	10.3%	22.9%	31.4%	36.2%	36.8%
Rate of annual growth	---	21.1%	13.8%	11.0%	10.5%
Middle East					
International Freight TK Performed	210	1,320	2,420	2,820	3,005
% share of world international TKs	3.4%	7.0%	5.4%	5.1%	5.0%
Rate of annual growth	---	19.8%	7.4%	5.0%	6.5%
Latin America & Caribbean					
International Freight TK Performed	340	1,100	2,250	2,600	2,750
% share of world international TKs	5.6%	5.8%	5.0%	4.7%	4.6%
Rate of annual growth	---	12.2%	6.4%	6.0%	6.0%
Africa					
International Freight TK Performed	190	660	1,210	1,230	1,310
% share of world international TKs	3.1%	3.5%	2.7%	2.2%	2.2%
Rate of annual growth	---	12.9%	7.1%	6.5%	6.5%
World	6,100	18,900	44,900	55,600	60,300
Annual growth rate	---	12.1%	9.2%	7.5%	8.5%

Source: ICAO Circular 158-AT/57, 222-AT/90, PIO 10/94

1. Includes CIS countries

**. 1993 figures are indicative for 1994 figures.*

*** 1994 figures are forecasted, as per ICAO forecast of annual growth rate.*

****. 1969 TKs for Europe include an estimate of USSR of 230 million TKs - actual figure excluding USSR is 2700 million TKs.*

Appendix D.

Load factors by region at actual and an assumed 100% passenger load factor (TKs in billions)

Region	1974	1979	1984	1989	1993*	1994**
Europe						
1. % share of total intl capacity	22.7%	25.6%	23.6%	24.0%	22.9%	23.2%
2. Freight TKs available.	5.5%	9.6	12.0	18.7	23.5	25.1
3. TKs performed.	5.0%	7.9	10.5	16.6	19.0	20.4
4. Freight Load Factor	91.0%	82.3%	87.5%	88.7%	80.8%	81.2%
5. Unutilised capacities.	19.0%	17.7%	12.5%	11.3%	19.2%	18.8%
North America						
1. % share of total intl capacity	60.5%	45.6%	39.4%	39.7%	41.0%	40.7%
2. Freight TKs available.	14.6%	17.1	20.0	30.9	42.0	44.0
3. TKs performed.	3.1%	3.6	5.3	8.3	9.8	10.6
4. Freight Load Factor	21.2%	21.0%	26.5%	26.8%	23.3%	24.1%
5. Unutilised capacities.	78.8%	79.0%	73.5%	73.2%	76.7%	75.9%
Asia & Pacific						
1. % share of total intl capacity	11.7%	19.0%	20.1%	21.8%	23.7%	24.0%
2. Freight TKs available.	2.8%	7.1	10.2	17.0	24.3	25.9
3. TKs performed.	2.1%	4.3	8.8	14.1	20.2	22.3
4. Freight Load Factor	74.2%	60.6%	86.3%	82.9%	83.1%	86.1%
5. Unutilised capacities.	25.8%	39.4%	13.7%	17.1%	16.9%	13.9%
Middle East						
1. % share of total intl capacity	1.6%	4.5%	7.0%	6.5%	6.0%	5.8%
2. Freight TKs available.	0.4%	1.7	3.6	5.1	6.1	6.3
3. TKs performed.	0.3%	1.3	1.7	2.4	2.8	3.0
4. Freight Load Factor	75.0%	60.7%	47.2%	47.1%	45.9%	47.6%
5. Unutilised capacities.	25.0%	39.3%	52.8%	32.9%	54.1%	52.4%
Latin America & Caribbean						
1. % share of total intl capacity	2.0%	3.2%	5.3%	4.2%	3.6%	3.5%
2. Freight TKs available.	0.5%	1.2	2.7	3.3	3.7	3.8
3. TKs performed.	0.4%	1.1	1.6	2.3	2.6	2.8
4. Freight Load Factor	80.0%	91.6%	59.3%	69.7%	82.2%	73.8%
5. Unutilised capacities.	20.0%	8.4%	40.7%	30.3%	17.8%	26.2%
Africa						
1. % share of total intl capacity	1.5%	2.3%	4.6%	3.8%	2.8%	2.8%
2. Freight TKs available.	0.4%	1.0	2.3	3.0	2.9	3.0
3. TKs performed.	0.3%	0.7	1.1	1.2	1.2	1.3
4. Freight Load Factor	75.0%	70.0%	47.8%	40.0%	41.4%	43.3%
5. Unutilised capacities.	25.0%	30.0%	52.2%	60.0%	58.6%	66.7%
Total TKs performed	11.2	18.9	28.9	44.9	55.6	60.3
Total freight TKs available	24.2	37.6	50.8	78.0	102.4	108.1

Source : *Computed as per Tables in Chapter 2 and Appendices B and C.*

Appendix E

The technique adopted is detailed as follows:

A. Average available cargo capacities per annum were calculated by taking cargo capacity per type of aircraft designated use, passengers, combis and pure freighters as officially declared by manufacturers and confirmed through interviews with the airlines. Airline's confirmation of actual figures of loadable cargo capacities were applied, when noticeably different from the manufacturers declared figures. Capacities were multiplied by an averaged number of total flights per annum, taking into consideration ICAO findings of peak to trough variations in flight frequencies to stabilise traditionally during the month of September at 8.3% of total frequencies per annum. 8.3% multiplied by 12 months = 99.6%, thus reducing seasonal variation to less than half a percentage point at 0.04%.

Example; KLM has 3 wide-bodied, PAX flights/week from Vancouver to Amsterdam, during September, with a bellyhold declared actual capacity of 10 tonnes per flight. Available capacity per annum is reached, therefore, by multiplying 3 flights x 52 weeks x 10 tonnes = 1,560 tonnes, rounded to 1,600 tonnes of available average air cargo capacity per annum. This formula of assessing available cargo capacities, per month of September frequencies, and per type of aircraft designated use is applied throughout this research, unless otherwise, specifically mentioned in the Table footnote, in which case, the reasons for higher/lower capacities are described.

B. Airlines confirmed that air cargo capacities depended largely on distance flown in terms of flying hours, and therefore, fuel requirements came first. The longer the range, the more the fuel requirement and the less is the capacity left for air cargo, with a given passenger load factor. Therefore, in the Tables showing air cargo capacity available, per airline, figures of the same aircraft with the same designated use, may differ from one airline to another, depending on whether these airlines are operating a non-stop long range route or availing a stop enroute, whereby re-fuelling takes place and, therefore, a high air cargo capacity at the starting point of the flight. The variations in air cargo capacities available may vary ± 5% of the average payload, especially onboard mixed flights, passengers and cargo.

The abbreviations used in all airline cargo capacities' tabulations in Chapter 5, regarding the type of aircraft and its designated use, are decoded as per class of service available on the flights.

Class of service available on the flight

BBF *Pure freighter flights carrying loose cargo.*

BBQ *Mixed configuration (combi) aircraft carrying loose load cargo on the passenger deck.*

LLF *Pure freighter flights carrying containerised cargo (ULD's).*

LLJ *Passenger flights operated by wide-bodied aircraft carrying containerised cargo.*

LLQ *Mixed configuration (combi) aircraft carrying containerised cargo on the passenger deck.*

LPF *Pure freighter flights carrying containerised/palletised cargo.*

LPJ *Passenger flights operated by wide-bodied aircraft carrying containerised/palletised cargo.*

LPQ *Mixed configuration (combi) aircraft carrying containerised/palletised cargo on the passenger deck.*

PPF *Pure freighter flights carrying palletised cargo.*

PPJ *Passenger flights operated by wide-bodied aircraft carrying palletised cargo.*

PPQ *Mixed configuration (combi) aircraft carrying palletised cargo on the passenger deck.*

Source :- ABC Air Cargo Guide

The decoding of aircraft general designator codes and average cargo payload capacity, per type of aircraft designation, reflected the codes, as is declared by the manufacturers and confirmed by the airlines from actual experience. Airlines confirmation of actual payload capacities were adopted in case they differed markedly from the manufacturer's declared cargo payload. Average cargo capacities of pure freighter services were computed on the basis of a long range, non-stop flight of 7 to 8 flying hours. In the cases of passenger or mixed wide-bodied flights, air cargo capacity was computed on the basis of a long range 7 - 8 flying hours with an average passenger payload factor of 75%

Description	Code	Average cargo capacity/flight
McDonnell Douglas DC-8 (all series)	DC8	6 tonnes
McDonnell Douglas DC-10 Freighter	D1F	60 tonnes
McDonnell Douglas DC-10 (mixed config)	D1M	20 tonnes
McDonnell Douglas DC-10 all series-PAX	D10	10 tonnes
McDonnell Douglas DC-8 Freighter	D8F	40 tonnes
McDonnell Douglas DC-8 (mixed config)	D8M	12 tonnes
McDonnell Douglas MD-11 Freighter	M1F	60 tonnes
McDonnell Douglas MD-11 pax	M11	10 tonnes
McDonnell Douglas MD-11 (mixed config)	M1M	15 tonnes
McDonnell Douglas MD-80 (all series)	M80	6 tonnes
McDonnell Douglas MD-87 (all series)	M87	6 tonnes
Airbus Industrie A310 all series	310	8 tonnes
Airbus Industrie A319-A321 pax	32S	8 tonnes
Airbus Industrie A330	330	8 tonnes
Airbus Industrie A340 all series	340	9 tonnes
Boeing 707 freighter	70F	40 tonnes
Boeing 727 freighter	72F	15 tonnes
Boeing 727 mixed	72M	6 tonnes
Boeing 737-200 freighter	73F	30 tonnes
Boeing 737-200 mixed	73M	6 tonnes
Boeing 737-300	733	8 tonnes
Boeing 737-400	734	8 tonnes
Boeing 737-500	735	8 tonnes
Boeing 737 all series pax	737	6 tonnes
Boeing 747-300 mixed	74D	30 tonnes
Boeing 747-400 mixed	74E	30 tonnes
Boeing 747 freighter all series	74F	100 tonnes
Boeing 747 SP	74L	12 tonnes
Boeing 747 mixed	74M	30 tonnes
Boeing 747-300 pax	743	10 tonnes
Boeing 747-400 pax	744	22 tonnes
Boeing 747 pax all series	747	10 tonnes
Boeing 757 freighter	75F	38 tonnes
Boeing 757 pax	757	8 tonnes
Boeing 767-300/300er	763	8 tonnes
Boeing 767 all series	767	10 tonnes
Boeing 777	777	10 tonnes
Lockheed L1011 Tristar all series (PAX)	L10	5 tonnes
Lockheed L1011 500 series (PAX)	L15	8 tonnes

Appendix E-1:

Scheduled international flights
(Freighters, Combis and Passenger)
from Vancouver Airport to major gateway hubs in Europe

*(Available average cargo capacities rounded to the nearest 100 tonnes)**

Airline	A/C type	Days of the week flights operate	Cargo capacity per annum	Destination
KLM	747 LPJ	1,3,6	1500	AMSTERDAM
CANADIAN PACIFIC	D10 LPJ	1,3,5,6,	1500	FRANKFURT
"	747 LPJ	3,4,5,6,7	2500	"
LUFTHANSA	D10 LPJ	1,3,5,6,	1500	"
"	747 LPJ	3,4,5,6,7	2000	"
"	747 PPF	7	4900	"
AIR CANADA	74E LPQ	1,3,5,6	5900	LONDON
"	747 LPJ	2,4	1000	"
"	767 LPJ	2,4,7	1500	"
BRITISH AIRWAYS	747 LPJ	Daily	3400	"
CANADIAN PACIFIC	763 LPJ	Daily	2800	"
AIR CANADA	767 LPJ	2,5	1000	PARIS
Total available cargo capacity per annum, Vancouver to major European gateways			**29,500 tonnes**	

Source : *Air Cargo timetable, Number 440, September 1994.*

Notes : *Air Canada freighter service was suspended in early 1992 and was replaced by a once weekly freighter service by Lufthansa. Federal Express has been discounted from the analysis (refer detailed explanation under Appendix E-4)*

LPJ : Wide-bodied PAX flights carrying containerised/palletised cargo in their under-deck holds.
PPF : Pure freighter flights carrying containerised/palletised cargo.
LPQ : Mixed configuration (combi) aircraft carrying containerised/palletised cargo on the passenger deck.
* *Capacities of each airline is calculated with utmost accuracy possible. Aircraft of the same type, with similar operations (freighter or passengers) may have varying degrees of available air cargo capacities due to the sector flown (long or short range) and fuel requirements. More fuel requirements means less available air cargo capacity on the sector flown. This is applied for calculation of air cargo capacities in all the following tables appearing in this study.*

Appendix E-2:

Scheduled international flights
(Freighters, Combis and Passenger)
from Toronto Airport to major gateway hubs in Europe
(Available average cargo capacities rounded to the nearest 100 tonnes)

Airline	A/C type	Days of the week flights operate	Cargo capacity per annum	Destination
Air Canada	767 LPJ[1]	4,7	1000	Berlin
"	767 LPJ	1,4,5,7	2000	Dusseldorf
"	763 LPJ	1,2,5,6	1500	Glasgow
"	M11 LPJ	3,5	1000	Helsinki
"	767 LPJ	2,7	1000	London
"	747 LPJ	1,3,5,6,7	2500	"
"	74M LPJ	1,5	3000	"
"	767 LPJ	2,6	1000	Lyon
"	D10 LPJ	3,5,7	1100	Madrid
"	767 LPJ	1,2,5,6	2000	Manchester
"	74M LPQ	7	1500	Paris
"	747 LPJ	1	500	"
"	310 LPJ	2,6	800	Prague
"	767 LPJ	6	500	Vienna
"	767 LPJ	3,5,6	1500	Zurich
"	M11 LPJ	Daily	3400	"
Canadian Pacific	763 LPJ	1,3,6	1200	Manchester
"	763 LPJ	2,5,7	1200	Milan
"	763 LPJ	2,4,5,6,7	1900	Munich
"	763 LPJ	1,2,4,5,6,7	2300	Paris
"	763 LPJ	Daily	2600	Rome
Lufthansa	747 LPJ	Daily	3400	Frankfurt
"	767 LPJ	2,4,5,6,7	2500	Munich
KLM	747 LPJ	1,2,4,5	2000	Amsterdam
"	74M LPQ	3,6,7	4400	"
British Airways	747 LPJ	Daily	3400	London
Air France	74F LLF	7	4900	Paris
"	763 LPJ	Daily	3400	"
Alitalia	M11 LPJ	2,5,4,7	2000	Rome
Swissair	M11 LPJ	Daily	3400	Zurich
Finnair	M11 LPJ	3,5	1000	Helsinki
Air Portugal	310 LLJ	4,7	800	Lisbon
Air India	744 LLJ	2,5,6	3400	London
Iberian	D10 LPJ	3,5,7	1100	Madrid
Czechoslovakian	310 LPJ	2,6	800	Prague
Balkan	767 LLJ	5	500	Sofia
Total available cargo capacity per annum, Toronto to major European gateways			**71,100 tonnes**	

Source : *Air Cargo timetable, Number 440, September 1994.*

Notes : *Federal Express has been discounted from the analysis (refer detailed explanation under Appendix E-4).*

Codes :
LLF : Pure freighter flights carrying containerised (ULDs) cargo.
LPJ : Wide-bodied PAX flights carrying containerised/palletised cargo in their under-deck holds.
LPQ : Mixed configuration (combi) aircraft carrying containerised/palletised cargo on the passenger deck.

Appendix E-3:

Scheduled international flights
(Freighters, Combis and Passenger)
from Montreal Airport to major gateway hubs in Europe
(Available average cargo capacities rounded to the nearest 100 tonnes)

Airline	A/C type	No. of flights per week	Cargo capacity per annum	Destination
Air Canada	767 LPJ	7	2,900	London
"	D10 LPJ	2	900	Madrid
"	767 LPJ	4	1,700	Nice
"	747 LPJ	6	3,100	Paris
"	74M LPQ	1	1,600	"
"	310 LLJ	1	400	Prague
Canadian Pacific	763 LPJ	2	800	Rome
Air Canada	767 LPJ	1	400	Warsaw
"	M11 LPJ	7	3,400	Zurich
K L M	747 LPJ	5	2,600	Amsterdam
Olympic Airways	747 LLJ	2	1,100	Athens
Lufthansa	310 LPJ	6	2,400	Frankfurt
Lufthansa	340 LPJ	1	400	Frankfurt
Tap	310 LPJ	2	800	Lisbon
British Airways	744 LPJ	7	8,000	London
Iberian	D10 LPJ	2	900	Madrid
Air France	74F LLF	2	10400	Paris
Air France	744 LPJ	7	8,000	Paris
C S A	310 LLJ	1	400	Prague
Alitalia	M11 LPJ	2	1,000	Rome
Lot Polish	767 LPJ	1	400	Warsaw
Swiss Air	M11 LPJ	7	3,400	Zurich

Total available cargo capacity per annum, Montreal to major European gateways **50,600 tonnes**

Source : *Air Cargo timetable, Number 440, September 1994.*
Notes : *Federal Express has been discounted from the analysis (refer detailed explanation under Appendix E-4).*

Appendix E-4

Scheduled international flights from Seattle
(Freighters, Combis and Passenger)
to major gateway hubs in Europe

(Available average cargo capacities rounded to the nearest 100 tonnes)

Airline	A/C type	Days of the week flights operate	Cargo capacity per annum	Destination
Martinair	767 LPJ	2,3,6	1,600	Amsterdam
	D1F	1	3,000	
Scandinavian	763 LPJ	Daily	2,800	Copenhagen
Northwest	D10 LPJ	1,3,5,6,7	2,000	Frankfurt
United Airlines	763 LPJ	1,2,3,5,6	2,000	London
British Airways	767 LPJ	Daily	3,400	"
Cargolux	747 F	1,2,3	12,500*	Luxembourg
Federal Express	D1F	1,2,3,4,5	17,500	Brussels
Total available cargo capacity per annum, Seattle to major European gateways			44,800 tonnes	
less Fedex			17,500 tonnes	
Total available cargo capacity per annum, Seattle to European gateways, excluding Fedex			**27,300 tonnes**	

Source : *Air Cargo timetable, Number 440, September 1994.*

Note: *Martinair upgrades one additional freighter flight per week during season of 43 weeks.*

* *Cargolux additional frequency per week occurs over 30 weeks per annum.*
1. *LPJ, Passenger flights operated by wide-bodied aircraft carrying containerised (ULDs)/palletised cargo*
2. *F, all freighter series*
3. *Federal Express flights and available cargo capacities are dropped from total available capacity to sea-air cargo, as Fedex specialises in fast courier services, moving parcels and pouches, mainly door to door. 'In 1990, Federal Express carried documents or packages not exceeding 68 kgs or 3.3 metres in length and width combined. It offered services including 'Overnight Letter', 'Priority One' (delivery within USA by 10.30 the next business day) and 'Standard Air', which offered delivery no later than the second working day. Forwarders and other middle men were cut out.'* ***Doganis, Rigas, 1992, 'Flying Off Course, The Economics of International Airlines', Routledge, London, pp 320 -321.***
   Further, Fedex weight limit per package of 68 kgs is applicable to door to door pick up and deliveries. While airport to airport air freight movement is not limited (source; Federal Express brochures, schedules & periodicals).

Appendix E-5:

Scheduled international flights (Freighters, Combis and Passenger) from Atlanta Airport to major gateway hubs in Europe

(Available average cargo capacities rounded to the nearest 100 tonnes)

Airline	A/C type	No. of flights per week	Cargo capacity per annum	Destination
<u>European Carriers</u>:				
KLM	74M LPQ	5	7,400	Amsterdam
Sabena	L10 LPJ	7	1,800	Brussels
Lufthansa	340 LPJ	7	2,800	Frankfurt
Lufthansa	74F PPF	2	9,800	"
British Airways	D10 LPJ	7	2,800	London
Swiss Air	74D LPQ	4	6,200	Zurich
Swiss Air	743 LPJ	2	1,000	Zurich
Swiss Air	M11 LPJ	1	500	Zurich
Total available cargo capacity per annum, from Atlanta to major European gateways on European Carriers			**32,300**	
Percentage of total capacity			**51.4%**	
<u>North American Carriers</u>:				
Northwest	747 LPJ	5	2,500	Amsterdam
Delta Airlines	L15 LPJ	7	2,800	"
Delta Airlines	L15 LPJ	7	2,800	Brussels
United Airlines	340 LPJ	7	2,800	Frankfurt
Delta Airlines	763 LPJ	7	2,800	"
Delta Airlines	L15 LPJ	7	2,800	"
Delta Airlines	L15 LPJ	14	5,600	London
Delta Airlines	L15 LPJ	7	2,800	Madrid
Delta Airlines	L15 LPJ	7	2,800	Paris
Delta Airlines	763 LPJ	7	2,800	Rome
Total available cargo capacity per annum, from Atlanta to major European gateways on North American Carriers			**30,500**	
Total available cargo capacity per annum, Atlanta to major European gateways			**62,800**	

Source : *Air Cargo timetable, Number 440, September 1994.*
<u>*Notes*</u> : *Federal Express has been discounted from the analysis (refer detailed explanation under Appendix E-4).*

Appendix E-6:

Scheduled international flights (Freighters, Combis and Passenger) from Boston Airport to major gateway hubs in Europe

(Available average cargo capacities rounded to the nearest 100 tonnes)

Airline	A/C type	No. of flights per week	Cargo capacity per annum	Destination
<u>European Carriers</u>:				
Sabena	310 LPJ	6	2,400	Brussels
Lufthansa	340 LPJ	7	2,800	Frankfurt
British Airways	747 LPJ	14	6,900	London
Virgin Atlantic	747 LPJ	7	3,500	"
Air France	74F LLF	2	9,800	Paris
Alitalia	M11 LPJ	7	3,500	Rome
Swiss Air	74D LPQ	1	1,500	Zurich
Swiss Air	743 LPJ	6	2,400	"
Total available cargo capacity per annum, Boston to major European gateways on European Carriers			**32,800**	
Percentage of total capacity			**57.0%**	
<u>North American Carriers</u>:				
Delta Airlines	D10 LPJ	7	2,800	Amsterdam
Northwest	D10 LPJ	7	2,800	"
United Airlines	340 LPJ	7	2,800	Frankfurt
Northwest	D10 LPJ	6	2,400	"
Northwest	D10 LPJ	7	2,800	Glasgow
American Airlines	763 LPJ	7	2,800	London
Northwest	D10 LPJ	7	2,800	"
Northwest	D10 LPJ	6	2,400	Paris
TWA	767 LPJ	7	2,800	"
Total available cargo capacity per annum, Boston to major European gateways on North American Carriers			**24,400**	
Total available cargo capacity per annum, Boston to major European gateways			**57,200**	

Source : *Air Cargo timetable, Number 440, September 1994.*

<u>Notes</u> : *Federal Express has been discounted from the analysis (refer detailed explanation under Appendix E-4*

Codes: LPJ/LLJ - Pax flights carrying containerised/palletised cargo
LPQ - Combi flights carrying containerised/palletised cargo
PPF/LPF - Pure freighter flights carrying containerised/palletised cargo

Appendix E-7.

Freighters and mixed flights from Miami to major gateway hubs in Europe

(Available cargo capacities rounded to the nearest 100 tonnes)

Airline	A/C type	Number of flights per week	Cargo capacity per annum	Destination
Martinair	747 LPJ	1	500	Amsterdam
"	767 LPJ	3	1,500	"
			2,000	
L.T.U Airlines	L15 LPJ	2	800	Dusseldorf
Lufthansa	74F PPF	4	20,000	Frankfurt
"	747 LPJ	7	3,500	"
"	74M LPQ	7	10,500	"
Lufthansa	767 LPJ	3	1,500	Munich
Lufthansa	767 LPJ	3	1,500	Vienna
			37,000	
Finnair	M11 LPJ	1	500	Helsinki
British Airways	747 LPJ	7	3,500	London
"	767 LPJ	7	3,500	"
			7,000	
Virgin Atlantic	747 LPJ	5	2,500	"
Iberian	747 LPJ	7	3,500	Madrid
"	D10 LPJ	3	1,500	"
			5,000	
Lauda Air	763 LPJ	3	1,200	"
Lauda Air	763 LPJ	3	1,400	"
			2,600	
Air France	74F LLF	1	5,000	Paris
"	340 LPJ	5	2,500	"
			7,500	
Total available cargo capacity per annum, Miami to major European gateways carried by European carriers			64,900	
American Airlines	M11 LPJ	7	3,500	Brussels
American Airlines	763 LPJ	7	2,800	London
American Airlines	763 LPJ	7	2,800	"
American Airlines	763 LPJ	7	2,800	Paris
			11,900	
United Airlines	763 LPJ	7	2,800	"
T W A	L10 LPJ	7	1,800	Madrid
Total available cargo capacity per annum, Miami to major European gateways carried by US carriers			16,500	
Total available cargo capacity per annum, Miami to major European gateways			81,400	
El Al	74F LPF	1	5,200	Amsterdam

Source : *Air Cargo timetable, Number 440, September 1994.*
Notes : *Federal Express has been discounted from the analysis (refer detailed explanation under Appendix E-4.*

Appendix E-8:

Scheduled international flights (Freighters, Combis and Passenger) from New York Airport to major gateway hubs in Europe (European Carriers)

(Available average cargo capacities rounded to the nearest 100 tonnes)

Airline	A/C type	No. of flights per week	Cargo capacity per annum	Destination
K L M	74M LPQ	7	10300	Amsterdam
K L M	747 LPJ	7	3,500	Amsterdam
Sabena	74D LPQ	7	10300	Brussels
SAS	763 LPJ	7	2,800	Copenhagen
Lufthansa	74F PPF	6	29300	Frankfurt
Lufthansa	340 LPJ	21	8,300	"
British Airways	747 LPJ	28	14000	London
Virgin Atlantic	747 LPJ	21	10300	"
Iberian	747 LPJ	7	3500	Madrid
Alitalia	74F LPF	3	14600	Milan
Alitalia	74M LPQ	7	10300	"
Air France	747 LPJ	7	3,500	Paris
Air France	744 LPJ	7	8,000	"
Air France	74F LLF	6	29300	"
Air France	763 LPJ	7	2,800	"
Alitalia	747 LPJ	10	4,900	Rome
Alitalia	74F LPF	2	9,800	Rome
Alitalia	D10 LPJ	7	2,800	Rome
Total available cargo capacity per annum, from New York to major European gateways on European carriers			**178,300**	
Percentage of total capacity			**47.0%**	

Source : *Air Cargo timetable, Number 440, September 1994.*

Notes : *Federal Express has been discounted from the analysis (refer detailed explanation under Appendix E-4).*

Codes :

LPJ/LLJ - Pax flights carrying containerised/palletised cargo
LPQ - Combi flights carrying containerised/palletised cargo
PPF/LPF - Pure freighter flights carrying containerised/palletised cargo

Appendix E-9:

Scheduled International flights (Freighters, Combis and Passenger) from New York Airport to major gateway hubs in Europe (North American Carriers)

(Available average cargo capacities rounded to the nearest 100 tonnes)

Airline	A/C type	No. of flights per week	Cargo capacity per annum	Destination
Delta Airlines	763 LPJ	7	2,800	Amsterdam
Delta Airlines	310 LPJ	7	2,800	Copenhagen
Delta Airlines	L15 LPJ	7	1,800	"
Delta Airlines	763 LPJ	7	2,800	"
Delta Airlines	763 LPJ	7	2,800	"
Delta Airlines	763 LPJ	7	2,800	Paris
Delta Airlines	763 LPJ	7	2,800	Rome
Northwest	747 LPJ	14	7,000	Amsterdam
American Airlines	763 LPJ	7	2,800	Brussels
American Airlines	763 LPJ	28	11000	"
American Airlines	M11 LPJ	14	7,000	"
American Airlines	763 LPJ	7	2,800	"
United Airlines	767 LPJ	7	2,800	Brussels
United Airlines	340 LPJ	21	8,300	Frankfurt
United Airlines	767 LPJ	21	8,300	London
United Airlines	763 LPJ	7	2,800	Madrid
United Airlines	747 LPJ	7	3,500	"
T W A	L10 LPJ	1	300	"
T W A	747 LPJ	7	3,500	"
T W A	L10 LPJ	7	2,800	"
T W A	767 LPJ	6	2,400	Milan
T W A	747 LPJ	4	2,000	"
T W A	747 LPJ	14	7,000	Rome
T W A	767 LPJ	6	2,400	Rome
Continental A/L	747 LPJ	7	3,500	"
Continental A/L	747 LPJ	7	3,500	"
Continental A/L	747 LPJ	3	1,500	"
Continental A/L	D10 LPJ	4	1,600	"
Continental A/L	D10 LPJ	7	2,800	"
Federal Express	72F LPF	4	2,900	"
Federal Express	D1F LPF	5	14600	"
Canadian Pacific	763 LPJ	3	1,100	"
US Air	767 LPJ	7	2,800	"
Total available cargo capacity per annum, from New York to major European gateways, on N. American carriers			**129,600**	
Percentage of total capacity			**34.0%**	

Source: Air Cargo timetable, Number 440, September 1994.

<u>Notes</u> : *Federal Express has been discounted from the analysis (refer detailed explanation under Appendix E-4).*
Delta Airlines operate 74D LPQ flights on a code-sharing basis with Sabena, and are therefore not included to avoid a double counting.

Appendix E-10:

Scheduled international flights (Freighters, Combis and Passenger) from New York to major gateway hubs in Europe (on carriers other than European and North American)

(Available average cargo capacities rounded to the nearest 100 tonnes)

Airline	A/C type	No. of flights per week	Cargo capacity per annum	Destination
El Al	74F LPF	6	29,300	Amsterdam
Singapore A/L	744 LPJ	3	3,400	Amsterdam
Tower Air	747 LLJ	1	600	Amsterdam
Biman	D10 LLJ	2	1,100	Amsterdam
P I A	74M LPQ	2	2,900	Amsterdam
Royal Jordanian	L15 LLJ	5	2,000	Amsterdam
DHL Cargo	D8F LLF	5	9,800	Brussels
Saudia	74F LPF	2	9,800	Brussels
Singapore A/L	744 LPJ	4	2,000	Frankfurt
P I A	747 LPJ	2	1,000	"
P I A	70F LPF	1	1,500	"
P I A	74M LPQ	1	1,500	"
P I A	310 LPJ	4	1,600	"
Kuwait Airways	747 LLJ	1	600	"
Air India	744 LLJ	7	3,500	London
Kuwait Airways	747 LPJ	3	1,500	"
P I A	74M LPQ	1	1,500	Paris
Total available cargo capacity per annum, from New York to major European gateways on carriers other than North American and European			73,600	
Percentage of total capacity			19.0%	

Source : *Air Cargo timetable, Number 440, September 1994.*
Notes : *Federal Express has been discounted from the analysis (refer detailed explanation under Appendix E-4).*
Codes: LPJ/LLJ - Pax flights carrying containerised/palletised cargo
LPQ - Combi flights carrying containerised/palletised cargo
PPF/LPF - Pure freighter flights carrying containerised/palletised cargo

Appendix F-1

Total air cargo (tonnes) loaded/offloaded
by airlines operating scheduled international services at Los Angeles Airport

Airlines	1990	1991	1992	1993	1994
European Carriers					
Air France	23,700	24,700	21,000	21,700	24,400
Alitalia	14,100	12,100	12,500	8,100	14,100
AOM (UTA)	280	200	160	-	600
UTA	420	300	240	-	900
British Airways	23,000	19,200	18,900	18,000	20,500
Cargolux	-	-	-	1,000	14,500
Iberia	3,700	2,300	2,100	1,900	-
KLM	16,600	12,600	13,300	13,200	13,000
Lauda	-	-	-	1,000	800
LTU International	-	-	200	500	800
Lufthansa	33,700	27,400	19,400	18,400	16,300
Matinair	1,700	5,200	2,400	3,300	3,100
SAS	7,800	6,600	5,100	5,500	3,500
Swissair	5,700	7,200	7,800	10,300	11,400
Virgin	5,600	9,400	8,800	8,800	10,300
Finnair	2,600	2,700	-	-	-
Total	**138,900**	**129,900**	**111,900**	**111,700**	**134,200**
El Al[1]	(26,400)	(18,800)	(10,700)	(14,000)	(15,800)
US Carriers[2]					
American Airlines	63,200	64,300	65,400	71,300	76,600
Delta Airlines	76,800	80,200	83,100	76,800	76,500
Northwest	46,700	45,500	48,600	49,400	77,500
Continental	36,200	37,500	38,200	40,500	51,600
US Air	14,000	13,900	14,100	14,800	14,800
TWA	26,400	28,100	30,200	25,200	24,000
United	107,600	106,000	109,000	119,500	110,200
Total[2]	370,300	375,500	388,600	397,500	431,200

Source : Los Angeles Airport Authority, release of April 1995.

1. *El Al carries sea-air cargo and cargo bound for Israel and Europe.*
2. *US carriers' total figures include air cargo loaded/offloaded at Los Angeles Airport from/to all airports they serve (Far East/Europe/USA/Canada/South and Central America, etc.). The seven US carriers, together, provide a total air cargo capacity of 50,500 tonnes from Los Angeles Airport to Europe per annum - Appendix F-3, and therefore their combined air carriage of cargo cannot exceed their declared scheduled cargo capacities.*

Appendix F-2.

Air exports/imports between Los Angeles Airport and Europe (rounded to the nearest hundred tonnes)

Country	1990	1991	1992	1993	1994
U.K.					
Exports	22,100	22,400	29,500	22,600	23,600
Imports	7,300	7,100	10,800	8,700	9,200
Total	29,400	29,500	40,300	31,300	32,800
Export % of total	**75.2%**	**75.9%**	**73.2%**	**72.2%**	**72.0%**
Germany					
Exports	15,600	18,000	17,700	16,900	15,900
Imports	9,000	9,400	8,500	9,500	10,200
Total	24,600	27,400	26,200	26,400	26,100
Export % of total	**63.4%**	**65.7%**	**67.6%**	**64.0%**	**60.9%**
France					
Exports	8,000	6,000	10,500	9,800	9,100
Imports	4,200	3,900	5,100	6,600	6,400
Total	12,200	9,900	15,600	16,400	15,500
Export % of total	**65.6%**	**60.6%**	**67.3%**	**59.8%**	**58.7%**
Italy					
Exports	6,200	6,900	8,400	6,100	5,400
Imports	6,100	6,400	6,000	7,600	10,400
Total	12,300	13,300	14,400	13,700	15,800
Export % of total	**50.4%**	**51.9%**	**58.3%**	**44.5%**	**34.2%**
Netherlands					
Exports	6,800	7,100	8,600	7,600	6,200
Imports	3,000	3,200	3,300	4,200	4,300
Total	9,800	10,300	11,900	11,800	10,500
Export % of total	**69.4%**	**68.9%**	**72.3%**	**64.4%**	**59.0%**
Switzerland					
Exports	4,300	4,200	5,000	4,700	4,900
Imports	1,500	1,700	1,700	1,700	2,500
Total	5,800	5,900	6,700	6,400	7,400
Export % of total	**74.1%**	**71.2%**	**74.6%**	**73.4%**	**66.2%**
Sweden					
Exports	2,000	2,400	2,500	1,800	1,800
Imports	800	800	800	800	800
Total	2,800	3,200	3,300	2,600	2,600
Export % of total	**71.4%**	**75.0%**	**75.8%**	**69.2%**	**69.2%**
Belgium					
Exports	2,800	2,800	3,500	2,900	3,100
Imports	1,500	500	1,700	2,300	2,000
Total	4,300	3,300	5,200	5,200	5,100
Export % of total	**65.1%**	**84.8%**	**67.3%**	**55.8%**	**60.8%**
Spain					
Exports	2,500	3,300	3,600	3,600	2,000
Imports	500	600	600	600	1,000
Total	3,000	3,900	4,200	4,200	3,000
Export % of total	**83.3%**	**84.6%**	**85.7%**	**85.7%**	**66.7%**
Norway					
Exports	700	1,000	900	800	700
Imports	200	200	200	500	200
Total	900	1,200	1,100	1,300	900
Export % of total	**77.8%**	**83.3%**	**81.8%**	**61.5%**	**77.8%**

Source: Compiled/tabulated from data released by U.S. Dept. of Commerce, Bureau of the Census, IM145 & EM 545, Trade Inflo, 7311-X Grove Road, Frederick MD21701.

Appendix F-2.

Air exports/imports between Los Angeles Airport and Europe (rounded to the nearest hundred tonnes)

Country	1990	1991	1992	1993	1994
Ireland					
Exports	200	200	1,000	1,900	1,900
Imports	400	400	400	400	400
Total	600	600	1,400	2,300	2,300
Export % of total	**33.3%**	**33.3%**	**71.4%**	**82.6%**	**82.6%**
Denmark					
Exports	1,000	1,000	1,300	1,400	900
Imports	400	600	400	600	800
Total	1,400	1,600	1,700	2,000	1,700
Export % of total	**71.4%**	**62.5%**	**76.5%**	**70.0%**	**52.9%**
Austria					
Exports	1,200	1,300	1,100	1,500	900
Imports	400	400	600	600	700
Total	1,600	1,700	1,700	2,100	1,600
Export % of total	**75.0%**	**76.5%**	**64.7%**	**71.4%**	**56.3%**
Turkey					
Exports	800	1,000	700	500	300
Imports	700	800	1,300	700	2,600
Total	1,500	1,800	2,000	1,200	2,900
Export % of total	**53.3%**	**55.6%**	**35.0%**	**41.7%**	**10.3%**
Finland					
Exports	400	700	500	300	400
Imports	300	300	200	300	200
Total	700	1,000	700	600	600
Export % of total	**57.1%**	**70.0%**	**71.4%**	**50.0%**	**66.7%**
Greece					
Exports	300	400	300	300	300
Imports	100	100	-	100	100
Total	400	500	300	400	400
Export % of total	**75.0%**	**80.0%**	**100.0%**	**75.0%**	**75.0%**
Portugal					
Exports	200	300	200	200	200
Imports	300	400	300	400	300
Total	500	700	500	600	500
Export % of total	**40.0%**	**42.9%**	**40.0%**	**33.3%**	**40.0%**
Luxembourg					
Exports	-	-	-	-	500
Imports	-	-	100	-	-
Total	-	-	100	-	500
Export % of total	**-**	**-**	**-**	**-**	**100.0%**
Others					
Exports	2,100	2,300	300	400	200
Imports	1,900	2,300	-	-	200
Total	4,000	4,600	300	400	400
Export % of total	**52.5%**	**50.0%**	**100.0%**	**100.0%**	**66.7%**
Total					
Exports	77,200	81,300	95,600	83,300	78,300
Imports	38,600	39,100	42,000	45,600	52,300
Total	115,800	120,400	137,600	128,900	130,600
Export % of total	**66.7%**	**81.8%**	**89.5%**	**84.4%**	**67.6%**

Source: Compiled/tabulated from data released by U.S. Dept. of Commerce, Bureau of the Census, IM145 & EM 545, Trade Inflo, 7311-X Grove Road, Frederick MD21701.

Appendix F-3:

Scheduled international flights from Los Angeles to major gateway hubs in Europe

(Available average cargo capacities rounded to the nearest 100 tonnes)

(1994)

Airline	A/C type	No. of flights per week	Cargo capacity per annum	Destination
<u>European Carriers</u>:				
Martinair	767 LPJ	1	500	Amsterdam
Martinair	747 LPJ	4	2,000	Amsterdam
K L M	747 LPJ	4	2,000	Amsterdam
K L M	74M LPQ	4	6,200	Amsterdam
Lufthansa	747 LPJ	7	3,500	Frankfurt
Lufthansa	74F LPF	2	9,800	Luxembourg
Lufthansa	767 LPJ	3	1,200	Munich
Lufthansa	767 LPJ	3	1,200	Vienna
LTU	M11 LPJ	2	1,000	Dusseldorf
Swiss Air	M11 LPJ	2	1,000	Geneva
Swiss Air	M11 LPJ	7	3,500	Zurich
Virgin Atlantic	744 LPJ	7	8,000	London
British Airways	744 LPJ	14	16,000	London
British Airways	767 LPJ	4	1,600	Manchester
Cargolux	74F LPF	3	15,600	Luxembourg
Iberian	747 LPJ	7	3,500	Madrid
Alitalia	74F LPF	2	9,800	Milan
Alitalia	M11 LPJ	4	2,000	Milan
Alitalia	M11 LPJ	7	2,000	Rome
Alitalia	74F LPF	1	4,900	Rome
Air France	74F LLF	1	4,900	Paris
Air France	744 LPJ	3	3,300	Paris
Air France	74E LLQ	7	10,500	Paris
AOM French A/L	D10 LPJ	3	1,200	Paris
Lauda Air	763 LPJ	3	1,200	Munich
Lauda Air	763 LPJ	3	1,200	Vienna
Lauda Air	L15 LPJ	7	3,500	Nice

SAS & Finn Air operate regular frequencies from other points in the US; In agreement with US carriers (UA, AA & TWA) they air lift their cargo from Los Angeles Airport to points such as New York for further on-carriage by air on SAS and Finn Air regular international flight services to their countries in Europe.

Total available cargo capacity per annum, Los Angeles to major European gateways on European Carriers	121,100
Percentage of total capacity	65.0%

<u>North American Carriers:</u>				
Northwest	747 LPJ	7	3,500	Amsterdam
United Airlines	767 LPJ	7	2,800	Amsterdam
United Airlines	744 LPJ	7	8,000	Frankfurt
United Airlines	74E LLQ	1	1,500	Frankfurt
United Airlines	763 LPJ	7	2,800	London
United Airlines	767 LPJ	7	3,500	London
United Airlines	763 LPJ	3	1,200	Paris
TWA	763 LPJ	7	2,800	Paris
TWA	L10 LPJ	4	1,000	Paris
U S AIR	767 LPJ	7	2,800	Frankfurt
Delta Airlines	M11 LPJ	7	3,500	Frankfurt
Continental A/L	D10 LPJ	1	400	London
Continental A/L	D10 LPJ	4	1,600	Madrid
Continental A/L	747 LPJ	3	1,500	Madrid
American Airlines	763 LPJ	7	2,800	London
American Airlines	763 LPJ	7	2,800	Paris
T W A	L10 LPJ	7	2,000	London
T W A	767 LPJ	3	1,500	Milan
T W A	747 LPJ	3	1,500	Milan
T W A	747 LPJ	6	3,000	Rome
Total available cargo capacity per annum, Los Angeles to major European gateways on North American Carriers			50,500	
<u>Percentage of total capacity</u>			<u>27.1%</u>	
<u>Other Carriers:</u>				
LY[1]	74F LPF	3	14,700	Amsterdam
Total available cargo capacity per annum, Los Angeles to major European gateways			**186,300**	

Source : Air Cargo timetable, Number 440, September 1994.

Note : Air cargo capacity figures do not include provisions for low season from/to Los Angeles Airport, as many major airlines such as Lufthansa, Martinair, El Al etc. resort to 'chartering' during high seasons, adding twice to three times as much air capacity to their regular schedules.

Federal Express has been discounted from the analysis (refer detailed explanation under Table 4, Appendix II).

1. El Al (LY) of Israel operate via Amsterdam to Tel Aviv, carrying air export cargo bound for Israel, and whatever balance of available capacity is used for sea-air cargo which is off-loaded in Amsterdam for further distribution to various European destinations.

Codes: LPJ/LLJ - Pax flights carrying containerised/palletised cargo
LPQ - Combi flights carrying containerised/palletised cargo
PPF/LPF - Pure freighter flights carrying containerised/palletised cargo

Appendix F-4.

Freighters and mixed flights from Los Angeles
to major gateway airports in South and Central America
(Available average cargo capacities rounded to the nearest 100 tonnes - 1994)

Airline	A/C type	No. of flts/week	Cargo capacity per annum	Destination
Aerolineas Argentinas	310LLJ	3	1200	Bogota
Aerolineas Argentinas	310LLJ	6	2400	Buenos Aires
Aerolineas Argentinas	310LLJ	3	1200	Lima
Challenge Air Cargo	75FLPF	1	2000	Caracas
Challenge Air Cargo	75FLPF	1	2000	Manaus
Challenge Air Cargo	75FLPF	1	2000	Sao Paulo
SAETA	310LLJ	2	800	Guayaquil
SAETA	310LLJ	2	800	Quito
United Airlines	763LPJ	7	2800	Sao Paulo
Delta Airlines	L10LPJ	1	300	Sao Paulo
Delta Airlines	743LLJ	2	800	Sao Paulo
Delta Airlines	743LLJ	2	800	RiodeJaneiro
Delta Airlines	D10LPJ	1	400	RiodeJaneiro
VARIG	D10LLJ	2	800	Lima
VARIG	743LPJ	1	400	Lima
VARIG	D1FLPF	1	3000	Manaus
VARIG	D10LLJ	2	800	RiodeJaneiro
VARIG	743LLJ	4	1600	RiodeJaneiro
VARIG	D1FLLJ	2	6000	RiodeJaneiro
VARIG	D10LLJ	2	800	Sao Paulo
VARIG	743LLJ	4	1600	Sao Paulo
Lan Chile	767LPJ	2	1000	Lima
Lan Chile	767LPJ	2	1000	Santiago
Lan Chile	D8FLPF	2	4000	Santiago
VASP	M11LLJ	3	1500	RiodeJaneiro
VASP	M11LLJ	3	1500	Sao Paulo
Avianca	744LLJ	2	2200	Caracas
Korean Air	744LLJ	3	3300	Sao Paulo
Japan Airlines	747LPJ	2	1000	Sao Paulo
Total			**43,000**	
<u>To Central America/Caribbean</u>				
Qantas*	74MLPQ	2	3000	Papeete
Air New Zealand*	747LLJ	2	1000	Papeete
Air France*	744LLJ	3	3300	Papeete
Aeromexpress*	D8FLPF	5	10000	Mexico City
Malaysia Airlines*	744LLJ	2	1000	Mexico City
Delta Airlines	L10LPJ	7	2100	San Juan
American Airlines	D10LPJ	7	2800	San Juan
VARIG	D1FLPF	2	6000	Panama
Aviateca	L10LPJ	7	2200	Guatemala
Mexicana	D8FLPF	2	4000	Mexico
TACA	D1FLPF	2	6000	San Salvador
Lan Chile	D8FLPF	2	4000	Panama
Total			**42,400**	

Source : *Air Cargo timetable, Number 440, September 1994.*

Appendix F-5:

Total air cargo (tonnes) loaded/offloaded
by international airlines operating between
Los Angeles Airport and South/Central America

Airlines	1990	1991	1992	1993	1994
S. American Carriers					
Aerolineas *(Argentina)*	1,800	1,700	1,900	1,700	3,000
Lan Chile *(Chile)*	4,800	5,100	5,800	5,500	7,000
SAETA *(Ecuador)*	400	400	700	600	500
VARIG *(Brazil)*	7,000	7,100	7,900	9,700	11,100
VASP *(Brazil)*	1,800	1,600	1,900	1,700	1,900
Challenge Air Cargo *(US)*	-	-	-	1,600	3,200
Avianca *(Colombia)*	500	600	700	600	600
Total	**16,300**	**16,500**	**18,900**	**21,400**	**27,400**
C. American Carriers					
Aeromexpress *(Mexico)*	3,500	3,300	3,800	3,800	4,300
Aeromexico *(Mexico)*	3,400	2,800	3,800	3,800	800
Aviateca *(Guatemala)*	300	300	400	1,700	100
Mexicana *(Mexicana)*	5,800	6,100	6,700	6,500	9,000
TACA Intnl *(El Salvador)*	2,800	3,000	3,300	4,500	5,400
Total	**15,800**	**15,500**	**18,000**	**20,300**	**19,600**
Others[1]					
United A/L	108,200	105,300	109,000	119,500	110,200
Delta A/L	81,300	80,200	83,100	76,800	76,500
Qantas	21,900	21,700	22,100	22,700	25,200
Air NZ	11,200	11,500	11,700	11,700	18,000
Air France	20,900	21,500	21,000	21,700	24,300
Malaysia	10,500	11,800	14,800	11,800	10,300
Japan A/L	40,100	42,500	44,900	39,000	47,600
Korean A/L	78,300	82,900	87,500	102,500	108,800

Source: Los Angeles Airport Authority, release of April 1995.

1. *Other airlines' figures include total cargo handled (loaded/offloaded) on all their worldwide international routes from/to LAX. Therefore, the air cargo capacities made available by those airlines to South/Central America must be taken into consideration as cargo uplift from Los Angeles Airport cannot exceed the cargo capacities specified in Appendix F-4, page 271.*

Appendix F-6.

Domestic made air exports from Los Angeles Airport
to South and Central America
(rounded to the nearest hundred tonnes)

Country	1990	1991	1992	1993	1994
South America					
Brazil	1,100	1,300	2,000	2,000	2,700
Argentina	300	300	1,500	1,300	1,500
Chile	600	600	1,100	1,000	1,100
Columbia	100	100	100	200	400
Others	100	500	300	300	400
Total	**2,200**	**2,800**	**5,000**	**4,800**	**6,100**
Central America					
Mexico	2,600	2,500	2,500	2,800	3,000
Puerto Rico	800	900	800	900	1,000
Guatemala	100	100	100	200	200
San Salvador	800	1,000	900	1,000	1,200
Panama	1,200	1,200	1,300	1,300	1,200
Tahiti	300	300	400	400	400
Others	100	100	200	100	200
Total	**5,900**	**6,100**	**6,200**	**6,700**	**7,200**

Source: U.S. Dept. of Commerce, Bureau of the Census, IM145 & EM 545, Trade Inflo, 7311-X Grove Road, Frederick, MD 21701.

Appendix F-7.

Air exports/imports between Los Angeles Airport
and South America by country
(rounded to the nearest hundred tonnes)

Country	1990	1991	1992	1993	1994
Brazil					
Exports	1,100	1,300	2,000	2,000	2,700
Imports	500	800	1,700	1,800	2,100
Total	1,600	2,100	3,700	3,800	4,800
Export % of total	68.8%	61.9%	54.1%	52.6%	56.3%
Argentina					
Exports	300	300	1,500	1,300	1,500
Imports	300	300	200	100	200
Total	600	600	1,700	1,400	1,700
Export % of total	50.0%	50.0%	88.2%	92.9%	88.2%
Chile					
Exports	600	600	1,100	1,000	1,100
Imports	1,300	1,500	2,200	3,000	2,800
Total	1,900	2,100	3,300	4,000	3,900
Export % of total	31.6%	28.6%	33.3%	25.0%	28.2%
Columbia					
Exports	100	100	100	200	400
Imports	300	300	300	300	400
Total	400	400	400	500	800
Export % of total	25.0%	25.0%	25.0%	40.0%	50.0%
Peru					
Exports	100	100	100	100	200
Imports	1,000	1,100	900	1,300	2,200
Total	1,100	1,500	1,000	1,400	2,400
Export % of total	9.0%	6.7%	10.0%	7.1%	8.3%
Ecuador					
Exports	---	100	---	---	---
Imports	300	400	1,000	1,300	1,600
Total	300	500	1,000	1,300	1,600
Export % of total	- %	20.0%	--%	--%	--%
Others					
Exports	300	300	100	100	200
Imports	700	800	300	200	100
Total	1,000	1,100	400	300	300
Export % of total	**30.0%**	**27.3%**	**25.0%**	**33.3%**	**66.7%**
Total					
Exports	2,500	2,800	4,900	4,700	6,100
Imports	4,400	5,200	6,600	8,000	9,400
Total	6,900	8,000	11,500	12,700	15,500
Export % of total	**36.2%**	**35.0%**	**42.6%**	**37.0%**	**39.4%**

Source: Compiled/tabulated from data released by U.S. Dept. of Commerce, Bureau of the Census, IM145 & EM 545, Trade Inflo, 7311-X Grove Road, Frederick MD21701.

Appendix F-8:

Scheduled international flights from San Francisco to major gateway hubs in Europe

(Available average cargo capacities rounded to the nearest 100 tonnes)

Airline	A/C type	No. of flights per week	Cargo capacity per annum	Destination
European Carriers:				
Lufthansa	74M LPQ	1	1,500	Frankfurt
"	74F PPF	2	10,000	"
"	747 LPJ	7	3,500	"
KLM	747 LPJ	1	500	Amsterdam
"	74M LPQ	3	4,500	"
British Airways	747 LPJ	14	7,000	London
Virgin Atlantic	747 LPJ	14	7,000	London
Cargolux	74F LPF	2	10,000	Luxembourg
Lufthansa	74F PPF	2	10,000	Luxembourg
Air France	74M LPQ	4	6,000	Paris
Air France	74F LPF	2	10,000	Paris
Total available cargo capacity per annum, San Francisco to major European gateways on European Carriers			69,400	
Percentage of total capacity			51.7%	
North American Carriers:				
United Airlines	747 LPJ	7	3,500	Amsterdam
"	767 LPJ	7	3,500	London
"	747 LPJ	7	3,500	"
"	763 LPJ	2	800	"
"	D10 LPJ	7	3,500	Frankfurt
"	74E LPQ	1	1,500	"
"	744 LPJ	7	3,500	"
Northwest	D10 LPJ	7	3,500	"
"	747 LPJ	4	2,000	Amsterdam
T W A	767 LPJ	7	3,500	Lisbon
Delta Airlines	310 LPJ	7	2,800	"
American Airlines	767 LPJ	7	3,500	London
T W A	L10 LPJ	7	1,800	"
United Airlines	747 LPJ	7	3,500	Madrid
American Airlines	767 LPJ	7	3,500	Manchester
T W A	767 LPJ	7	3,500	Milan
American Airlines	767 LPJ	7	3,500	Paris
American Airlines	L10 LPJ	7	1,800	"
United Airlines	763 LPJ	4	1,600	"
T W A	767 LPJ	7	3,500	Rome
United Airlines	747 LPJ	7	3,500	Zurich
American Airlines	767 LPJ	7	3,500	"
Total available cargo capacity per annum, San Francisco to major European gateways on North American Carriers			64,800	
Total available cargo capacity per annum, San Francisco to major European gateways			**134,200**	
El Al	74F LPF	3	15,000	Amsterdam

Source : Air Cargo timetable, Number 440, September 1994.

Appendix G-1

Freighters and mixed flights from Miami to major gateway hubs in Europe

(Available cargo capacities rounded to the nearest 100 tonnes)

Airline	A/C type	Number of flights per week	Cargo capacity per annum	Destination
Martinair	747 LPJ	1	500	Amsterdam
"	767 LPJ	3	1,500	"
			2,000	
L.T.U Airlines	L15 LPJ	2	800	Dusseldorf
Lufthansa	74F PPF	4	20,000	Frankfurt
"	747 LPJ	7	3,500	"
"	74M LPQ	7	10,500	"
Lufthansa	767 LPJ	3	1,500	Munich
Lufthansa	767 LPJ	3	1,500	Vienna
			37,000	
Finnair	M11 LPJ	1	500	Helsinki
British Airways	747 LPJ	7	3,500	London
"	767 LPJ	7	3,500	"
			7,000	
Virgin Atlantic	747 LPJ	5	2,500	"
Iberian	747 LPJ	7	3,500	Madrid
"	D10 LPJ	3	1,500	"
			5,000	
Lauda Air	763 LPJ	3	1,200	"
Lauda Air	763 LPJ	3	1,400	"
			2,600	
Air France	74F LLF	1	5,000	Paris
"	340 LPJ	5	2,500	"
			7,500	
Total available cargo capacity per annum, Miami to major European gateways carried by European carriers			64,900	
American Airlines	M11 LPJ	7	3,500	Brussels
American Airlines	763 LPJ	7	2,800	London
American Airlines	763 LPJ	7	2,800	"
American Airlines	763 LPJ	7	2,800	Paris
			11,900	
United Airlines	763 LPJ	7	2,800	"
T W A	L10 LPJ	7	1,800	Madrid
Total available cargo capacity per annum, Miami to major European gateways carried by US carriers			16,500	
Total available cargo capacity per annum, Miami to major European gateways			81,400	
El Al	74F LPF	1	5,200	Amsterdam

Source : Air Cargo timetable, Number 440, September 1994.

Appendix G-2.

Freighters and mixed flights from Miami to major gateway hubs in S. America

(Available cargo capacities rounded to the nearest 100 tonnes)

Airline	A/C type	Number of flights per week	Cargo capacity per annum	Destination
Amerjet Intl	72F PPF	1	800	Antigua
Amerjet Intl	72F PPF	2	1,600	Barbados
Amerjet Intl	72F PPF	1	800	San Juan
			3,200	
Arrow Air	D8F LPF	1	2,000	Asuncion
Arrow Air	D8F LPF	2	4,000	Buenos Aires
Arrow Air	D8F LPF	6	12,000	Panama City
Arrow Air	D8F LPF	3	6,000	Quito
Arrow Air	D8F LPF	6	12,000	San Juan
Arrow Air	D8F LPF	3	6,000	Santiago
			42,000	
Ladeco Cargo	70F LPF	3	6,000	Asuncion
Ladeco Cargo	70F LPF	1	2,000	Buenos Aires
Ladeco Cargo	70F LPF	4	8,000	Iquique
Ladeco Cargo	70F LPF	1	2,000	Montevideo
Ladeco Cargo	70F LPF	7	14,000	Santiago
			32,000	
Tampa Airlines	D8F LPF	7	14,000	Bogota
Tampa Airlines	D8F LPF	3	6,000	Caracas
Tampa Airlines	D8F LPF	7	14,000	Medellin
			34,000	
TransBrasil	767 LLJ	4	2,000	Brasilia
TransBrasil	767 LLJ	7	3,500	RiodeJaneiro
Transbrasil	767 LLJ	7	3,500	Sao Paulo
			9,000	
VASP	M11 LLJ	1	500	RiodeJaneiro
VASP	M11 LLJ	3	1,500	Sao Paulo
VASP	M11 LLJ	3	1,500	Sao Paulo
			3,500	
VARIG	D1F LPF	1	3,000	RiodeJaneiro
"	767 LPJ	7	3,500	RiodeJaneiro
VARIG	D1F LPF	1	2,500	Sao Paulo
Varig	767 LPJ	1	500	Manaus
"	D10 LLJ	7	3,500	Sao Paulo
			13,000	
LAN Chile	767 LPJ	7	3,500	Buenos Aires
Lan Chile	70F LPF	1	2,000	Iquique
	D8F LPF	2	4,000	Iquique
LAN Chile	D8F LPF	3	6,000	Santiago
"	70F LPF	1	2,000	Santiago
"	767 LPJ	7	3,500	Santiago
LAN Chile	D8F LPF	1	2,000	Montevideo
			23,000	
Fine Air Cargo	D8F LLF	5	10,000	Caracas
Fine Air Cargo	D8F LLF	2	4,000	Guatemala City
Fine Air Cargo	D8F LLF	2	4,000	Managua
Fine Air Cargo	D8F LLF	3	6,000	Panama City
Fine Air Cargo	D8F LLF	3	6,000	San Jose

Fine Air Cargo	D8F LLF	2	4,000	San Pedro
			34,000	
Fast Air Carrier	70F LPF	6	12,000	Panama City
Fast Air Carrier	70F LPF	4	8,000	Iquique
Fast Air Carrier	70F LPF	1	2,000	Montevideo
Fast Air Carrier	70F LPF	4	8,000	Santiago
			30,000	
LAB	70F LPF	3	6,000	La Paz
LAB	310 LPJ	4	1,600	La Paz
LAB	310 LPJ	1	400	Manaus
LAB	70F LPF	3	6,000	Santa Cruz
LAB	310 LPJ	3	1,200	Santa Cruz
			15,200	
Aerovias Colombia	D8F LPF	7	14,000	Bogota
Aerovias Colombia	D8F LPF	2	4,000	Medellin
			18,000	
Aeromar Cargo	D8F LPF	6	12,000	San Domingo
"	70F BBF	6	12,000	San Domingo
"	L10 LPJ	6	1,500	San Domingo
			25,500	
Million Air Cargo	70F LPF	2	4,000	Quito
Million Air	70F LPF	7	14,000	Bogota
			18,000	
Others				
ServicdeTransport	70F LPF	3	6,000	Buenos Aires
Aerolineas	747 LLJ	7	3,500	Buenos Aries
Del Sur	70F LPF	5	10,000	Buenos Aires
Aviateca	D8F PPF	2	4,000	Guatemala City
Tikal Jets	D8F LPF	2	4,000	Guatemala City
Aeroperu	D10 LLJ	7	3,500	Lima
CompaniaDeAviacon	D10 LLJ	4	2,000	Lima
Aeronaves DelPeru	70F LPF	2	4,000	Lima
Export AirDelPeru	D8F LPF	1	2,000	Lima
Central American	D8F LPF	1	2,000	Managua
Lineas Aereas	D8F LPF	2	4,000	Medellin
Pacific Intl	72F LPF	3	2,300	Panama City
Air Caribbean	72F BBF	2	900	Panama City
COPA	73F LPF	5	7,500	Panama City
Andes Airlines	D8F LPF	1	2,000	Quito
SAETA	310 LLJ	7	2,800	Quito
Airborne Express	D9F LPF	5	10,000	San Juan
TACA Intl. A/L	767 LLJ	7	3,500	San Salvador
SantaCruz Air	D8F PPF	1	2,000	Santa Cruz
Aerochago A/L	D8F PPF	3	6,000	San Domingo
Lineas Aereas	D8F PPF	7	14,000	Bogota
Avianca	767 LLJ	3	1,500	Bogota
			97,500	
Challenge	75F LPF	5	10,000	Guatemala City
Challenge	75F LPF	6	12,000	Bogota
Challenge	75F LPF	5	10,000	Caracas
Challenge	75F LPF	2	4,000	La Paz
Challenge	75F LPF	4	8,000	Lima
Challenge	75F LPF	2	4,000	Manaus
Challenge	75F LPF	6	12,000	Panama City
Challenge	75F LPF	6	12,000	Quito
Challenge	75F LPF	6	12,000	San Jose
Challenge	D8F PPF	7	14,000	San Jose
Challenge	75F LPF	5	10,000	San Pedro
Challenge	75F LPF	4	8,000	San Salvador
Challenge	D8F LPF	2	4,000	San Salvador
Challenge	75F LPF	2	4,000	Sao Paulo
			124,000	

American Airlines	AB3 LPJ	7	2,800	Antigua
American Airlines	763 LPJ	7	2,800	Asuncion
American Airlines	763 LPJ	7	2,800	Bogota
American Airlines	AB3 LPJ	7	2,800	Bogota
American Airlines	M11 LPJ	7	3,500	Buenos Aires
American Airlines	767 LPJ	7	3,500	Caracas
American Airlines	AB3 LPJ	7	2,800	Caracas
American Airlines	AB3 LPJ	7	2,800	Lima
American Airlines	AB3 LPJ	7	2,800	Panama City
American Airlines	763 LPJ	7	2,800	RiodeJaneiro
American Airlines	AB3 LPJ	7	2,800	San Juan
American Airlines	763 LPJ	7	2,800	Santiago
American Airlines	M11 LPJ	7	3,500	Santiago
American Airlines	767 LPJ	7	3,500	San Domingo
American Airlines	AB3 LPJ	7	2,800	San Domingo
American Airlines	763 LPJ	7	2,800	Sao Paulo
			47,600	
United Airlines	763 LPJ	7	2,800	Sao Paulo
United Airlines	747 LPJ	7	3,500	Buenos Aires
United Airlines	763 LPJ	7	2,800	RiodeJaneiro
United Airlines	763 LPJ	7	2,800	Santiago
			11,900	
Delta Airlines	767 LPJ	7	3,500	RiodeJaneiro
Delta Airlines	D10 LPJ	7	3,500	Sao Paulo
			7,000	
Total available cargo capacity per annum, Miami to major S. American gateways			588,400	

Source : *Air Cargo timetable, Number 440, September 1994.*

Appendix H-1

Freighters and mixed flights from Singapore
to major gateway hubs in Europe
(Available cargo capacities rounded to the nearest 100 tonnes)

Airline	A/C type	Number of flights per week	Cargo capacity per annum	Destination
KLM	74M LPQ	5	7,500	Amsterdam
	747 LPJ	4	2,000	"
	74F LPF	2	10,000	"
			19,500	
Garuda	747 LPJ	3	1,500	"
	744 LPJ	1	1,100	"
			2,600	
Indonesian	744 LPJ	1	1,100	Frankfurt
	M11 LPJ	1	500	"
Indonesian	744 LPJ	1	1,100	Madrid
"	M11 LPJ	1	500	"
Indonesian	M11 LPJ	1	500	Paris
	747 LPJ	1	500	"
Indonesian	747 LPJ	1	500	Rome
Indonesian	M11 LPJ	1	500	Zurich
	747 LPJ	1	500	Zurich
			5,700	
Quantas	744 LLJ	5	5,500	Frankfurt
Quantas	744 LLJ	7	7,700	London
Quantas	744 LLJ	7	7,700	Manchester
Quantas	744 LPJ	2	2,200	Rome
			23,100	
Lufthansa	74M LPQ	4	6,000	Frankfurt
	747 LPJ	3	1,500	"
			7,500	
Air France	744 LPJ	1	1,100	Paris
	74E LLQ	3	4,500	"
	340 LPJ	1	400	"
			6,000	
Alitalia	747 LPJ	2	1,000	Rome
Swissair	M11 LPJ	7	3,500	Geneva
Royal Brunei	767 LPJ	2	800	London
British Airways	744 LPJ	7	7,700	London
Cargolux	74F LPF	3	15,000	Luxembourg
SAS	763 LPJ	6	2,400	Copenhagen
			30,400	
Singapore A/L	744 LPJ	5	5,500	Amsterdam
	74F LPF	1	5,000	"
Singapore A/L	744 LPJ	2	2,200	Brussels
	74F LPF	4	20,000	"
Singapore A/L	744 LPJ	3	3,300	Copenhagen
	74F LPF	2	10,000	"
Singapore A/L	74F PPF	1	5,000	Frankfurt
	744 LPJ	7	3,500	"
Singapore A/L	74F LPF	1	5,000	London
	744 LPJ	7	7,700	"
Singapore A/L	744 LPJ	2	2,200	Madrid
Singapore A/L	744 LPJ	3	3,300	Manchester
Singapore A/L	744 LPJ	2	2,200	Rome
Singapore A/L	743 LPJ	2	1,000	Vienna
Singapore A/L	744 LPJ	7	7,700	Zurich
			83,600	
Total available cargo capacity per annum Singapore to major European gateways			**178,400**	

Source : *Air Cargo timetable, Number 440, September 1994.*

Appendix H-2:

Freighters and mixed flights from Singapore
to major gateway hubs in Australia/N.Zealand
(Available cargo capacities rounded to the nearest 100 tonnes)

Airline	A/C type	Number of flights per week	Cargo capacity per annum	Destination
KLM	747 LPJ	2	1,000	Sydney
Quantas	767 LLJ	4	2,000	Adelaide
Quantas	74L LLJ	7	4,200	Brisbane
Quantas	763 LLJ	7	2,800	Cairns
Quantas	763 LLJ	5	2,000	Darwin
Quantas	744 LPJ	7	7,700	Melbourne
Quantas	763 LLJ	14	5,600	Perth
Quantas	763 LLJ	5	2,000	Sydney
Quantas	767 LLJ	5	2,500	Sydney
Quantas	744 LPJ	14	15,400	Sydney
Quantas	74L LLJ	7	4,200	Sydney
			48,400	
British Airways	744 LPJ	2	2,200	Auckland
British Airways	744 LPJ	2	2,200	Brisbane
British Airways	744 LPJ	3	3,300	Melbourne
British Airways	744 LPJ	3	3,300	Perth
British Airways	744 LPJ	3	3,300	Sydney
			14,300	
Air France	744 LPJ	1	1,100	Perth
	74E LLQ	1	1,500	"
			2,600	
Gulf Air	767 LLJ	3	1,500	Melbourne
Gulf Air	767 LLJ	3	1,500	Sydney
			3,000	
Air N.Z.	767 LLJ	4	2,000	Auckland
Air N.Z.	767 LLJ	1	500	Christchurch
			2,500	
Singapore A/L	743 LPJ	3	1,500	Adelaide
Singapore A/L	74F LPF	2	10,000	Auckland
Singapore A/L	743 LPJ	6	3,000	Auckland
Singapore A/L	743 LPJ	4	2,000	Brisbane
Singapore A/L	310 LPJ	1	400	Darwin
Singapore A/L	743 LPJ	1	500	Darwin
Singapore A/L	743 LPJ	3	1,500	Christchurch
Singapore A/L	743 LPJ	4	2,000	Melbourne
Singapore A/L	74D LPQ	3	4,500	Melbourne
Singapore A/L	310 LPJ	3	1,200	Perth
Singapore A/L	743 LPJ	3	1,500	Perth
Singapore A/L	747 LPJ	1	500	Perth
Singapore A/L	74F LPF	2	10,000	Sydney
Singapore A/L	744 LPJ	7	7,700	Sydney
			46,300	
Total available cargo capacity per annum Singapore to major Australian/N.Z. gateways			**118,100**	
Singapore A/L	744 LPJ	1	1,100	Cape Town
Singapore A/L	744 LPJ	1	1,100	Durban
Singapore A/L	744 LPJ	4	4,400	Johannesburg
			6,600	
South African A/L	747 LLJ	1	500	Cape Town
South African A/L	747 LLJ	3	1,500	Johannesburg
			2,000	
Total available cargo capacity per annum Singapore to South Africa			**8,600**	

Source : *Air Cargo timetable, Number 440, September 1994.*

Appendix I-1

Freighters and mixed flights from Dubai to major gateway hubs in Europe

(Available cargo capacities rounded to the nearest 100 tonnes)

Airline	A/C type	Number of flights per week	Cargo capacity per annum	Destination
KLM	310 LPJ	7	2,800	Amsterdam
	74F LPF	3	15,000	"
			17,800	
Malaysia A/L	74E LLQ	1	1,500	Amsterdam
Malaysia A/L	M1F LPF	1	1,500	"
Malaysia A/L	74E LLQ	2	3,000	Brussels
Malaysian A/L	74E LLQ	2	3,000	Rome
			9,000	
Singapore A/L	74F LPF	1	5,000	Amsterdam
Singapore A/L	74F LPF	3	15,000	Brussels
Singapore A/L	74F LPF	2	10,000	Copenhagen
Singapore A/L	74F LPF	1	5,000	London
Singapore A/L	74F LPF	1	5,000	Basle
			40,000	
Biman A/L	D10 LLJ	2	1,000	Amsterdam
Biman Airlines	D10 LLJ	5	2,500	London
			3,500	
Air Hong Kong	74F LPF	7	35,000	Brussels
Air Hong Kong	74F LPF	5	25,000	Manchester
			60,000	
Lufthansa	AB3 LPJ	4	1,600	Frankfurt
Lufthansa	310 LPJ	2	800	"
			2,400	
Royal Brunei	767 LPJ	2	1,000	Frankfurt
Royal Brunei	767 LPJ	2	1,000	London
			2,000	
Cathay Pacific	74F LPF	5	2,500	Frankfurt
Cathay Pacific	74F LPF	3	15,000	London
Cathay Pacific	74F LPF	2	10,000	Paris
			27,500	
Emirates Airlines	310 LPJ	5	2,000	Frankfurt
Emirates Airlines	310 LPJ	7	2,800	London
Emirates Airlines	AB3 LPJ	7	2,800	"
Emirates Airlines	AB3 LPJ	4	1,600	Manchester
Emirates Airlines	310 LPJ	3	1,200	Nice
Emirates Airlines	310 LPJ	3	1,200	Paris
Emirates Airlines	310 LPJ	3	1,200	Rome
Emirates Airlines	AB3 LPJ	2	800	Rome
			13,600	
Royal Nepal	310 LLJ	3	1,200	Frankfurt
Royal Nepal	310 LLJ	2	800	London
			2,000	
Air Lanka	340 LLJ	2	900	London
Air Lanka	L10 LLJ	2	500	London
Air Lanka	340 LLJ	2	900	Rome
			2,300	

Pakistan Intl.	747 LPJ	1	500	London
Pakistan Intl.	74M LPQ	1	1,500	London
			2,000	
Air France	74F LLF	2	10,000	Lyon
Air France	74F LLF	7	35,000	Paris
Air France	74M LLQ	1	15,000	Paris
Air France	310 LPJ	2	800	Paris
			60,800	
Alitalia	DBF PPF	3	6,000	Rome
Alitalia	AB3 LPJ	3	1,200	Rome
			7,200	
British Airways	767 LPJ	7	3,500	London
Olympic Airways	AB3 LLJ	2	800	Athens
Cargolux	74F LPF	2	10,000	Luxembourg
China Airlines	74F LPF	3	15,000	Luxembourg
Vietnam Airlines	763 LLJ	2	800	Paris
Swiss Air	310 LPJ	4	1,600	Zurich
Total available cargo capacity per annum Dubai to major European gateways			281,000	

Source : *Air Cargo timetable, Number 440, September 1994.*

Note : ***Computation of this table of airline cargo capacities was made on the assumption that all flights are terminator flights. However, research and interviews with all airlines transiting U.A.E. Airports revealed actual air cargo capacities made available were averaged and tabulated separately for each of the three major U.A.E. airports analysed in this section.***

Appendix I-2

Airline flights were divided into two classes :
1. Terminator flights
2. Transit flights

All airlines were interviewed and actual capacities of terminator flights were averaged over 50 weeks, rather than 52 weeks, taking care of a possible margin of error of 2 weeks of frequencies or 5% of the total.

Airlines transiting Dubai Airport on their way back to Europe, from the sub-continent of India and the Far east, were also interviewed, and an average capacity available per week, on their flights, was drawn and averaged over 50 weeks per annum. These interviews were updated in March 1995 with the same airlines. The air cargo capacity figures detailed below are the most likely and realistic figures:

A. Terminator flights - Dubai International Airport *capacities available on the return leg to Europe, from Dubai.*

Airline	Air cargo capacity(tonnes p.a)
1. Emirates Airlines	
Operate 35 passenger flights per week using Airbus 300 series, each having an average available air cargo capacity of 8 tonnes. 35 x 8 x 50 =	**14,000**
2. Kuwait Airways	
Operate 2 B707s, freighter flights per week, each with an average available air cargo capacity of 35 tons. 35 x 2 x 50 = 3,500 tonnes. Operate daily, Airbus, passenger flights, each with an average available air cargo capacity of 8 tonnes. 8 x 7 x 50 = 2,800 tonnes Total available air cargo capacity 3,500 + 2,800 =	**6,300**
3. Alitalia	
Operate 2 B747 combis per week, each having an average available air cargo capacity of 35 tonnes. 35 x 2 x 50 =	**3,500**

4. Swiss Air
Operate 8 Airbus 300 series passenger flights per week, each having an average available air cargo capacity of 8 tonnes.

8 x 8 x 50 =	3,200

5. Royal Jordanian
(terminators & transit flights, originating in India)
Operate 2 nos B707s, freighters, per week, and 6 L1011/Airbus 300 series passenger flights/week. They have, totally, an average available air cargo capacity of 125 tonnes per week.

125 x 50 =	6,300

6. Middle East Airlines
(terminators and transit flights originating Sydney, Australia)
Operate 5 passenger flights per week, using B707/Airbus 300 series, totally having an average available air cargo capacity of 40 tonnes per week.

40 x 50 =	2,000

7. Olympic
Operate 3 nos B737s passenger flights (sometimes upgraded for 3 months or so to Airbus 300 series) per week, each with an average available air cargo capacity of 3 tonnes.

8 x 2 x 50 =	800
8. Others	10,000

Total capacity available, sea-air carriers	46,100

Appendix I-3

B. Transit flights via Dubai:
Capacities available on the return leg to Europe, from Dubai.

Airline	Air cargo capacity (tonnes p.a)
1. K L M (transit - originating Far East points) Operate 7 B747 pure freighter per week and 7 Airbus 300 passenger flights (of which only 3 uplift cargo from Dubai). Each freighter having an average available air cargo capacity of 8 tonnes at Dubai. Each passenger flight having an average available air cargo capacity of 6 tonnes at Dubai. 7 x 8 x 50 = 2,800 tonnes per annum 3 x 6 x 50 = 900 tonnes per annum a total of	**3,700**
2. Cargolux (transit - other Middle East points) Operate 1 B747 pure freighter per week, each having an average available air cargo capacity of 70 tonnes at Dubai. 70 x 1 x 50 =	**3,500.**
3. Air France (transit - originating Bangkok) Operate 3 Airbus passenger flights per week and 5 B747s freighters per week, totally having an average available air cargo capacity of 250 tonnes per week. 250 x 50 =	**12,500**
4. Cathay Pacific (transit - originating HongKong) Operate 8 B747 freighter per week, each having an average available air cargo capacity of 8 tonnes at Dubai. 8 x 8 x 50 =	**3,200**
5. Singapore Airlines (transit - originating Singapore) Operate 6 B747 pure freighter per week, each having an average available air cargo capacity of 8 tonnes at Dubai. 8 x 6 x 50 =	**2,400**
6. Lufthansa Airlines (transit - originating India) Operate 7 Airbus passenger flights per week, each having an average available air cargo capacity of 8 tonnes. 8 x 7 x 50 =	**2,800**

7. British Airways
(transit - originating Muscat)
Operate 7 passenger flights per week, using Airbus 300, each having an average available air cargo capacity of 8 tonnes.

8 x 7 x 50 =	2,800

8. China Airlines
(transit - originating Taipei)
Operate 5 B747 pure freighter per week, each having an average available air cargo capacity of 7 tonnes at Dubai.

7 x 5 x 50 =	1,800.

9. Air Hong Kong
(transit - originating HongKong)
do not allocate any space, but offer their space to the local market as and when available, due to offloading of Dubai destined cargo, or when sometimes space becomes available from the origin point itself. Operate 5 B747 freighters per week, each having an average available air cargo capacity of 8 tonnes.

8 x 5 x 50 =	2,000

Total capacity available, sea-air carriers	34,700

Appendix I-4

Freighters and mixed flights
from Sharjah to major gateway hubs in Europe
(Available cargo capacities rounded to the nearest 100 tonnes)

Airline	A/C type	Number of flights per week	Cargo capacity per annum	Destination
Gulf Air	75F PPF	6	12,000	Brussels
Lufthansa	74F PPF	14	70,000	Frankfurt
	D8F PPF	3	6,000	"
T M A	70F LPF	7	14,000	London
Royal Jordanian	70F LPF	4	8,000	Maastricht
Total available cargo capacity per annum Sharjah to major European gateways			**110,000**	

Source : *Air Cargo timetable, Number 440, September 1994.*
Note : ***Computation of this table of airline cargo capacities was made on the assumption that all flights are terminator flights. However, research and interviews with all airlines transiting U.A.E. Airports revealed actual air cargo capacities made available were averaged and tabulated separately for each of the three major U.A.E. airports analysed in this section.***

Appendix I-5

Sharjah Airport total air exports were mainly directed to CIS countries through the services of 16 regular CIS charter airlines uplifting over 50,000 tonnes of cargo in 1994, from a total of 84,400 tonnes of air exports. The balance of 34,400 tonnes were destined west-bound, to Europe and North America. The main providers of air cargo capacities on the western route are :

Airline	Air cargo capacity(tonnes p.a)
1. Lufthansa Operate 6 B747s freighters and 1 DC8 freighter/week, terminators, having an average available air cargo capacity of: 6 x 100 x 50 = 30,000 tonnes 1 x 40 x 50 = 2,000 tonnes All these flights start from Germany and return from Sharjah Airport to the same point of origin. Lufthansa also operates 7 B747s freighters and 1 DC8 freighter per week that transit Sharjah originating from Far East/Indian sub-continent points. They are usually filled with originating cargo. The DC8 freighter is unable to provide any available air cargo space at Sharjah, while the 7 B747s provide an average air cargo capacity of 5 tonnes per flight. 5 x 7 x 50 = 1,800 tonnes Total air cargo capacity available out of Sharjah; 32,000 + 1,800 =	**33,800.**
2. Gulf Air Operates 6 weekly freighter frequencies from Sharjah Airport to Brussels, where the DHL trucking system took over the re-distribution to the whole region of Europe. Gulf Air uses a B757 freighter with a payload capacity of 40 tonnes/flight. 40 x 6 x 50 =	**12,000**
3. T M A (Trans Mediterranean Airline) Operate 7 weekly frequencies, utilising B707 freighters via Beirut, for onward air carriage to destinations in Europe, such as Basle, Frankfurt, Amsterdam, Paris and London, availing an air cargo capacity of 14,000 tonnes, but TMA made available 50% of this capacity for Beirut domestic air exports, and therefore Sharjah Airport gets only 7,000 tonnes of available air cargo capacity.	**7,000**

4. Royal Jordanian Airlines
applies the same policy as TMA, and avails only 50% of its capacity to Sharjah Airport. They operate 4 weekly B707 freighters.
40 x 4 x 50 = 8,000 tonnes, 50% of which is **4,000**

5. Others **10,000**

Therefore, the total air cargo capacity, available on the western route is **66,800 tonnes per annum.**

Appendix I-6.

Freighters and mixed flights
from Abu Dhabi to major gateway hubs in Europe
(Available cargo capacities rounded to the nearest 100 tonnes)

Airline	A/C type	Number of flights per week	Cargo capacity per annum	Destination
Gulf Air	767 LLJ	3	1,500	Amsterdam
Gulf Air	767 LLJ	2	1,000	Frankfurt
Gulf Air	340 LLJ	2	500	London
Gulf Air	767 LLJ	7	3,500	London
Gulf Air	767 LLJ	2	1,000	Manchester
Gulf Air	767 LLJ	3	1,500	Paris
Gulf Air	767 LLJ	2	1,000	Zurich
			10,000	
Garuda Indonesia	747 LPJ	6	3,000	Amsterdam
Garuda Indonesia	747 LPJ	3	1,500	London
Garuda	747 LPJ	3	1,500	London
Garuda Indonesia	M11 LPJ	1	500	Frankfurt
Garuda Indonesia	747 LPJ	1	500	Madrid
Garuda Indonesia	747 LPJ	1	500	Vienna
			7,500	
Emirates Airlines	310 LPJ	5	2,000	London
Emirates A/L	AB3 LPJ	3	1,200	London
			3,200	
Air France	310 LPJ	2	800	Paris
Air France	74F LLF	1	5,000	Paris
			5,800	
Air Lanka	L10 LLJ	3	800	Amsterdam
KLM	747 LPJ	2	1,000	Amsterdam
Lufthansa	AB3 LPJ	3	1,200	Frankfurt
British Airways	767 LPJ	7	3,500	London
Cargolux	74F LPF	5	35,000	Luxembourg
Swiss Air	310 LPJ	5	2,000	Zurich
Total available cargo capacity per annum Abu Dhabi to major European gateways			70,000	

Source : *Air Cargo timetable, Number 440, September 1994.*
Note : ***Computation of this table of airline cargo capacities was made on the assumption that all flights are terminator flights. However, research and interviews with all airlines transiting U.A.E. Airports revealed actual air cargo capacities made available were averaged and tabulated separately for each of the three major U.A.E. airports analysed in this section.***

Appendix I-7.

The main providers of air cargo capacities from Abu Dhabi Airport to Europe and North America are.

Airline	Air cargo capacity (tonnes p.a)
1. Gulf Air with 50% of its declared capacity (Table 137, above) made available for the western route.	**5,000**
2. Garuda	2,000
3. Emirates Airlines	2,000
4. Air France	5,800
5. British Airways	3,500
6. Cargolux	3,500
7. Swiss Air	2,000
8. Lufthansa	1,200
9. K L M	1,000
	26,000

Appendix J

Major World Ports

Analysis of container traffic
Tonnage: in millions. containers : in millions

Port	1987	1988	1989	1990	1991	1992	1993[1]	1994[2]
Singapore								
No. of loaded containers	2.1	2.8	3.6	4.3	5.2	6.5	7.7	9.1
No. of empties	0.5	0.6	1.2	0.9	1.2	1.1	1.2	1.1
Total	**2.6**	**3.4**	**4.8**	**5.2**	**6.4**	**7.6**	**8.9**	**10.2**
Total container tonnage	38.4	51.3	65.2	76.7	90.7	109.0	128.6	141.1
Containerisation degree (% of general cargo)	**74.1%**	**76.6%**	**78.1%**	**81.2%**	**83.8%**	**86.7%**	**87.1%**	**90.0%**
Hong Kong								
No. of loaded containers	2.8	3.4	3.7	4.2	5.2	6.5	7.6	8.7
No. of empties	0.7	0.6	0.7	0.9	1.0	1.1	1.1	1.1
Total	**3.5**	**4.0**	**4.4**	**5.1**	**6.2**	**7.6**	**8.7**	**9.8**
Total container tonnage	17.2	20.8	21.6	24.6	30.2	33.6	37.6	41.3
Containerisation degree (% of general cargo)	**32.6%**	**34.3%**	**35.1%**	**37.4%**	**38.1%**	**39.0%**	**40.1%**	**41.0%**
Kaoshiung (Taiwan)								
No. of loaded containers	2.3	2.6	2.8	2.9	3.3	3.6	3.9	4.2
No. of empties	0.5	0.5	0.6	0.6	0.6	0.4	0.4	0.5
Total	**2.8**	**3.1**	**3.4**	**3.5**	**3.9**	**4.0**	**4.3**	**4.7**
Total container tonnage	9.9	9.9	9.5	10.0	12.2	11.3	11.6	11.9
Containerisation degree (% of general cargo)	**61.3%**	**54.1%**	**57.9%**	**57.3%**	**59.5%**	**61.1%**	**62.3%**	**63.0%**
Rotterdam								
No. of loaded containers	1.7	1.8	2.1	2.1	2.1	2.3	2.4	2.6
No. of empties	0.3	0.4	0.3	0.3	0.3	0.4	0.4	0.4
Total	**2.0**	**2.2**	**2.4**	**2.4**	**2.4**	**2.7**	**2.8**	**3.0**
Total container tonnage	24.8	27.4	30.5	30.5	31.0	34.4	36.6	38.8
Containerisation degree (% of general cargo)	**51.7%**	**50.9%**	**51.0%**	**51.4%**	**50.5%**	**52.7%**	**53.1%**	**54.5%**
Kobe								
No. of loaded containers	1.6	1.8	2.0	2.1	2.1	2.1	2.2	2.3
No. of empties	0.3	0.7	0.3	0.3	0.3	0.3	0.3	0.3
Total	**1.9**	**2.1**	**2.3**	**2.4**	**2.4**	**2.4**	**2.5**	**2.6**
Total container tonnage	29.6	33.3	36.7	38.8	39.0	38.7	39.1	39.2
Containerisation degree (% of general cargo)								
Hamburg								
No. of loaded containers	0.9	1.0	1.1	1.6	1.8	1.8	2.1	2.4
No. of empties	0.2	0.2	0.2	0.4	0.4	0.5	0.4	0.5
Total	**1.1**	**1.2**	**1.3**	**2.0**	**2.2**	**2.3**	**2.5**	**2.9**
Total container tonnage	12.1	13.5	14.2	19.6	21.4	22.5	24.2	25.8
Containerisation degree (% of general cargo)	**49.1%**	**53.5%**	**53.9%**	**67.6%**	**71.2%**	**74.6%**	**75.0%**	**75.1%**
Los Angeles								
No. of loaded containers	1.2	1.3	1.6	1.6	1.6	1.7	1.6	1.7
No. of empties	0.4	0.3	0.5	0.5	0.4	0.4	0.5	0.4
Total	**1.6**	**1.6**	**2.1**	**2.1**	**2.0**	**2.1**	**2.1**	**2.1**
Total container tonnage								
Containerisation degree (% of general cargo)								

Appendix J:

Major World Ports

Analysis of container traffic

Tonnage: in millions. containers : in millions

Port	1987	1988	1989	1990	1991	1992	1993[1]	1994[2]
Long Beach								
No. of loaded containers	1.1	1.2	1.1	1.3	1.3	1.5	1.6	1.6
No. of empties	0.4	0.3	0.4	0.3	0.3	0.3	0.3	0.3
Total	**1.5**	**1.5**	**1.5**	**1.6**	**1.6**	**1.8**	**1.9**	**1.9**
Total container tonnage	24.1	26.7	27.9	29.9	30.7	34.7	37.1	39.3
Containerisation degree (% of general cargo)	**88.0%**	**88.6%**	**89.0%**	**90.1%**	**89.9%**	**90.9%**	**91.2%**	**91.4%**
Tokyo								
No. of loaded containers	1.1	1.2	1.2	1.3	1.5	1.5	1.6	1.7
No. of empties	0.2	0.2	0.2	0.3	0.3	0.3	0.3	0.3
Total	**1.3**	**1.4**	**1.4**	**1.6**	**1.8**	**1.8**	**1.9**	**2.0**
Total container tonnage								
Containerisation degree (% of general cargo)								
Yokohama								
No. of loaded containers	1.1	1.3	1.3	1.4	1.5	1.5	1.6	1.7
No. of empties	0.2	0.2	0.2	0.2	0.3	0.3	0.3	0.3
Total	**1.3**	**1.5**	**1.5**	**1.6**	**1.8**	**1.8**	**1.9**	**2.0**
Total container tonnage	18.5	20.4	21.5	23.6	25.4	26.9	82.2	87.2
Containerisation degree (% of general cargo)	**35.0%**	**36.6%**	**36.7%**	**38.2%**	**41.4%**	**42.4%**	**42.8%**	**43.2%**
Antwerp								
No. of loaded containers	0.9	1.2	1.2	1.3	1.4	1.5	1.6	1.7
No. of empties	0.2	0.3	0.3	0.2	0.4	0.3	0.3	0.3
Total	**1.1**	**1.5**	**1.5**	**1.5**	**1.8**	**1.8**	**1.9**	**2.0**
Total container tonnage	12.9	13.9	15.1	16.5	18.9	19.7	21.4	23.1
Containerisation degree (% of general cargo)	**32.6%**	**52.6%**	**35.8%**	**38.0%**	**41.7%**	**43.4%**	**45.1%**	**45.8%**
Keelung								
No. of loaded containers	1.5	1.4	1.0	1.1	1.2	1.2	1.3	1.3
No. of empties	0.4	0.4	0.2	0.2	0.2	0.3	0.3	0.3
Total	**1.9**	**1.8**	**1.2**	**1.3**	**1.4**	**1.5**	**1.6**	**1.6**
Total container tonnage	11.3	11.2	11.5	12.8	13.9	15.0	15.8	16.6
Containerisation degree (% of general cargo)	**77.3%**	**100%**	**73.3%**	**-**	**77.9%**	**80.0%**	**81.3%**	**81.9%**
San Juan								
No. of loaded containers	-	0.7	0.7	0.7	0.8	0.9	1.1	1.1
No. of empties	1.1	0.6	0.7	0.7	0.7	0.6	0.5	0.6
Total	**5.5**	**1.3**	**1.4**	**1.4**	**1.5**	**1.5**	**1.6**	**1.7**
Total container tonnage	-	5.6	6.1	6.3	7.3	7.8	8.2	8.6
Containerisation degree (% of general cargo)	**64.2%**	**61.6%**	**65.2%**	**64.2%**	**81.7%**	**82.0%**	**82.1%**	**82.0%**
Dubai Ports (Rashid & Jebel Ali)								
No. of loaded containers	0.4	0.5	0.7	1.0	1.0	1.1	1.4	1.7
No. of empties	0.2	0.2	0.2	0.3	0.3	0.3	0.3	0.3
Total	**0.6**	**0.7**	**0.9**	**1.3**	**1.3**	**1.4**	**1.7**	**2.0**
Total container tonnage	7.1	7.4	9.3	13.3	15.2	16.4	24.1	28.4
Containerisation degree (% of general cargo)	**56.2%**	**55.5%**	**58.4%**	**59.0%**	**62.1%**	**60.1%**	**61.0%**	**63.5%**

Appendix J

Major World Ports

Analysis of container traffic

Tonnage: in millions. containers : in millions

Port	1987	1988	1989	1990	1991	1992	1993[1]	1994[2]
Oakland								
No. of loaded containers	0.7	0.8	0.8	0.9	0.9	1.0	1.1	1.2
No. of empties	0.3	0.2	0.3	0.2	0.3	0.3	0.3	0.3
Total	**1.0**	**1.0**	**1.1**	**1.1**	**1.2**	**1.3**	**1.4**	**1.5**
Total container tonnage	12.4	12.7	12.8	13.4	14.5	18.1	19.5	20.8
Containerisation degree (% of general cargo)	**93.1%**	**94.3%**	**95.2%**	**96.5%**	**97.3%**	**98.0%**	**98.0%**	**98.0%**
Felixstowe								
No. of loaded containers	0.7	0.8	0.8	0.8	0.8	0.9	0.9	0.9
No. of empties	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.3
Total	**0.8**	**0.9**	**0.9**	**1.0**	**1.0**	**1.1**	**1.1**	**1.2**
Total container tonnage	9.5	11.4	11.8	12.7	12.7	13.0	13.1	13.7
Containerisation degree (% of general cargo)	-	-	-	**80.2%**	**80.4%**	**80.5%**	**80.6%**	**80.7%**
Bremen								
No. of loaded containers	0.7	0.9	1.0	1.0	1.1	1.1	1.1	1.2
No. of empties	0.4	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Total	**1.1**	**1.1**	**1.2**	**1.2**	**1.3**	**1.3**	**1.3**	**1.4**
Total container tonnage	9.8	10.4	11.6	11.4	12.1	12.6	13.2	13.8
Containerisation degree (% of general cargo)	**52.2%**	**53.8%**	**57.3%**	**58.7%**	**60.0%**	**63.6%**	**63.7%**	**64.1%**
Pusan								
No. of loaded containers	1.5	1.8	1.8	2.0	2.0	2.2	2.4	2.5
No. of empties	0.3	0.3	0.4	0.3	0.4	0.4	0.3	0.4
Total	**1.8**	**2.1**	**2.2**	**2.3**	**2.4**	**2.6**	**2.7**	**2.9**
Total container tonnage	34.4	40.0	40.2	42.4	42.2	44.7	47.8	50.6
Containerisation degree (% of general cargo)	**81.7%**	**86.5%**	**89.2%**	**87.9%**	**81.5%**	**91.0%**	**92.3%**	**93.0%**
Nagoya								
No. of loaded containers	0.5	0.6	0.7	0.8	0.8	0.9	1.0	1.2
No. of empties	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2
Total	**0.6**	**0.7**	**0.8**	**0.9**	**1.0**	**1.1**	**1.2**	**1.4**
Total container tonnage	9.9	11.6	13.8	15.4	17.4	19.2	22.0	24.7
Containerisation degree (% of general cargo)	**25.2%**	**27.0%**	**28.6%**	**31.3%**	**31.8%**	**34.3%**	**35.3%**	**34.9%**
Keelang								
No. of loaded containers	0.2	0.2	0.3	0.4	0.5	0.6	0.7	0.9
No. of empties	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Total	**0.3**	**0.3**	**0.4**	**0.5**	**0.6**	**0.7**	**0.8**	**1.0**
Total container tonnage	4.9	6.2	7.3	9.2	12.2	13.9	17.5	21.6
Containerisation degree (% of general cargo)	**57.8%**	**59.2%**	**62.5%**	**63.5%**	**67.4%**	**70.6%**	**74.1%**	**76.8%**
Bangkok								
No. of loaded containers	0.5	0.6	0.8	0.9	1.0	1.1	1.2	1.4
No. of empties	0.1	0.2	0.1	0.1	0.2	0.2	0.2	0.2
Total	**0.6**	**0.8**	**0.9**	**1.0**	**1.2**	**1.3**	**1.4**	**1.6**
Total container tonnage	6.2	7.9	8.7	10.0	11.5	12.7	14.8	16.6
Containerisation degree (% of general cargo)	-	-	-	-	-	-		

Appendix J

Major World Ports

Analysis of container traffic

Tonnage: in millions. containers : in millions

Port	1987	1988	1989	1990	1991	1992	1993[1]	1994[2]
Manila								
No. of loaded containers	0.6	0.7	0.8	0.9	0.9	0.9	1.0	1.1
No. of empties	0.1	0.1	0.1	0.2	0.2	0.3	0.3	0.3
Total	**0.7**	**0.8**	**0.9**	**1.1**	**1.1**	**1.2**	**1.3**	**1.4**
Total container tonnage	6.9	8.6	10.1	11.3	12.0	13.3	15.2	17.4
Containerisation degree (% of general cargo)	-	-	-	-	-	-		
New York (N.J.)								
No. of loaded containers								
No. of empties								
Total	**2.1**	**2.1**	**2.0**	**1.8**	**1.9**	**1.9**	**1.9**	**1.9**
Total container tonnage	11.8	12.2	12.5	-	-			
Containerisation degree (% of general cargo)	**88.7%**	**99.7%**	**92.7%**	-	-			
Tansong Priok (Indonesia)								
No. of loaded containers	0.1	0.3	0.5	0.5	0.6	0.7	0.9	1.1
No. of empties	0.1	0.3	0.1	0.1	0.1	0.1	0.1	0.1
Total	**0.2**	**0.4**	**0.6**	**0.6**	**0.7**	**0.8**	**1.0**	**1.2**
Total container tonnage	2.2	4.1	5.2	5.7	6.4	7.7	8.3	9.6
Containerisation degree (% of general cargo)	-	-	-	-	-	-	-	-
Algeciras (Spain)								
No. of loaded containers	0.3	0.3	0.3	0.4	0.5	0.7	0.7	0.8
No. of empties	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Total	**0.4**	**0.4**	**0.4**	**0.5**	**0.6**	0.8	0.8	0.9
Total container tonnage	4.3	4.2	3.5	4.9	6.6	7.0	7.3	7.9
Containerisation degree (% of general cargo)	**77.6%**	**76.8%**	**61.5%**	**71.0%**	**71.9%**	**72.4%**	**73.4%**	**75.1%**

Source : *ISL Shipping Statistics Yearbook, Institute of Shipping and Logistics (ISL), Bremen, October 1993.*

Notes : *Figures 1987 to 1992 were derived from ISL Yearbook 1993.*

1. & 2 : *Figures for 1993 and 1994 were derived from related periodicals and tested against ISL figures, and average percentage changes per year over six years (1987 - 1992) - periodicals such as the ICHCA Annual Review, World of cargo handling, London, March 1995.*

Appendix K-1

World Airports highest % annual growth
1980 - 1994 split into three 5 yr periods
passengers, freight tonnes & A/C movements
(in 1000s)

Airport N. American	1980	1984	Average annual % increase	1985	1989	Average annual % increase	1990	1994	Average annual % increase
BALTIMORE	USA								
A/C movmnts	205	268	6.1	285	245	-2.8	302	295	-0.5
Passengers	3,794	7,000	16.9	8,174	10,350	5.3	10,245	12,803	5.0
Frt tonnes	64	106	12.9	119	231	18.9	151	138	-1.7
DALLAS	USA								
A/C movmnts	452	540	3.9	562	699	4.9	731	853	3.3
Passengers	21,215	33,307	11.4	37,104	47,565	5.6	48,515	52,601	1.7
Frt tonnes	251	359	8.6	390	532	7.3	557	725	6.0
LA GUARDIA	USA								
A/C movmnts	312	342	1.9	348	349	0.06	354	338	-0.9
Passengers	17,069	19,886	3.3	20,542	23,158	2.5	22,754	20,808	-1.7
Frt tonnes	67	97	8.9	106	107	0.2	117	93	-4.0
NEWARK INTL	USA								
A/C movmnts	196	333	14.0	380	365	-0.8	379	436	3.0
Passengers	10,032	22,773	25.4	28,557	29,928	1.0	22,255	27,996	5.2
Frt tonnes	116	237	20.7	286	449	11.4	505	860	14.1
VANCOUVER	CANADA								
A/C movmnts	276	242	-2.5	236	325	7.5	318	297	-1.3
Passengers	7,370	6,817	-1.5	6,714	7,313	1.8	7,601	11,066	9.1
Frt tonnes	219	262	3.9	273	124	-10.9	121	182	10.0
PHILADELPHIA	USA								
A/C movmnts	330	349	1.1	353	374	1.2	407	403	-0.2
Passengers	9,398	10,996	3.4	11,370	14,809	6.0	16,290	17,372	1.3
Frt tonnes	178	160	-2.0	157	263	13.5	404	480	3.8
BOSTON	USA								
A/C movmnts	288	360	5.0	378	388	0.5	425	471	2.2
Passengers	14,289	19,148	6.8	20,450	22,272	1.8	22,936	25,360	2.1
Frt tonnes	208	282	7.1	302	341	2.6	363	476	6.2
DETROIT	USA								
A/C movmnts	261	355	7.2	380	374	-0.3	388	485	5.0
Passengers	9,621	14,240	9.6	15,607	21,500	7.6	22,585	26,798	3.7
Frt tonnes	126	161	5.6	170	179	1.1	192	329	14.3
HONOLULU	USA								
A/C movmnts	246	341	7.7	368	404	2.0	407	363	-2.2
Passengers	13,611	16,061	3.6	16,639	22,617	7.2	23,368	22,474	-0.8
Frt tonnes	169	207	4.5	216	364	13.7	375	396	1.1
LOS ANGELES	USA								
A/C movmnts	521	542	0.8	546	637	3.3	678	690	0.4
Passengers	32,473	36,694	2.6	37,648	44,967	3.9	45,810	51,050	2.3
Frt tonnes	799	835	0.9	843	1,130	6.8	1,164	1,545	6.5
MIAMI	USA								
A/C movmnts	451	343	-4.8	327	373	2.8	414	558	7.0
Passengers	20,586	19,968	-0.6	19,849	23,385	3.6	25,837	30,203	3.4
Frt tonnes	601	568	-1.1	562	797	8.4	967	1,333	7.6
NEWYORK(JFK)	USA								
A/C movmnts	312	290	-1.4	286	305	1.3	302	342	2.7
Passengers	26,379	28,490	1.6	28,945	30,323	1.0	29,787	28,799	-0.7
Frt tonnes	1,212	1,121	-1.5	1,105	1,372	4.8	1,322	1,443	1.8

SEATTLE/TAC	USA									
A/C movmnts		209	230	2.0	235	335	8.5	355	353	-0.1
Passengers		8,958	10,974	4.5	11,467	15,241	6.6	16,240	20,973	5.8
Frt tonnes		241	213	-2.3	208	294	8.3	252	415	12.9
CHICAGO	USA									
A/C movmnts		707	746	1.1	754	780	0.7	811	882	1.8
Passengers		42,262	47,333	2.4	48,469	59,130	4.4	59,936	66,435	2.2
Frt tonnes		798	746	-1.3	736	985	6.8	987	1,256	5.5
DULLES	USA									
A/C movmnts		161	199	4.7	208	225	1.6	242	285	3.6
Passengers		2,450	4,385	15.8	5,077	10,179	20.1	10,236	11,555	2.6
Frt tonnes		39	62	11.9	70	157	24.8	174	276	11.7

Appendix K-2

World Airports highest % annual growth
1980 - 1994 split into three 5 yr periods
passengers, freight tonnes & A/C movements
(1000s)

Airport European	1980	1984	Average annual % increase	1985	1989	Average annual % increase	1990	1994	Average annual % increase
LONDON(LHR) U.K.									
A/C movmnts	260	300	1.0	309	368	3.8	390	425	1.8
Passengers	19,897	28,751	2.7	31,310	39,588	5.3	42,635	51,728	4.3
Frt tonnes	439	566	2.4	599	757	5.3	774	1,047	7.1
LONDON(LGW) U.K.									
A/C movmnts	140	162	3.1	167	205	4.5	203	191	-1.2
Passengers	9,459	13,669	8.9	14,885	21,150	8.4	21,050	21,212	0.2
Frt tonnes	124	160	5.8	170	217	5.5	229	237	0.7
MANCHESTER U.K.									
A/C movmnts	82	93	2.8	96	74	-4.6	155	168	1.7
Passengers	4,191	5,658	7.0	6,054	10,059	13.2	10,146	14,814	9.2
Frt tonnes	26	33	5.6	35	73	21.7	81	97	3.9
BIRMINGHAM U.K.									
A/C movmnts	----	----	--	64	92	8.8	93	95	0.4
Passengers	----	----	--	1,634	3,333	21.0	3,492	4,949	8.3
Frt tonnes	3	5	13.7	6	15	30.0	23	20	-2.6
PARIS(CDG) FRANCE									
A/C movmnts	102	135	6.4	143	213	9.8	242	325	6.9
Passengers	9,816	13,595	7.7	14,642	20,275	7.7	22,508	28,680	5.5
Frt tonnes	410	506	4.7	530	611	3.1	647	898	7.8
PARIS(ORLY) FRANCE									
A/C movmnts	191	166	-2.6	161	205	5.5	202	216	1.4
Passengers	15,408	17,257	2.4	17,671	24,118	7.3	24,330	26,617	1.9
Frt tonnes	196	218	2.2	223	280	5.1	288	319	2.2
LYON FRANCE									
A/C movmnts	52	54	0.5	56	77	7.5	75	77	0.5
Passengers	2,478	2,577	0.8	2,598	3,630	7.9	3,734	4,257	2.8
Frt tonnes	59	25	-11.7	22	30	7.3	32	35	1.9
STOCKHOLM SWEDEN									
A/C movmnts	85	149	15.0	171	254	9.7	258	230	-2.2
Passengers	4,306	7,815	16.3	9,088	14,077	11.0	14,822	13,420	-1.9
Frt tonnes	60	73	4.4	76	104	7.4	96	92	-0.8
GOTHENBÜRG SWEDEN									
A/C movmnts	----	----	---	44	57	5.9	55	56	0.4
Passengers	1,424	1,830	5.7	1,934	2,802	9.0	2,870	2,938	0.5
Frt tonnes	18	26	9.4	29	26	-2.1	25	21	-3.2
OPORTO PORTUGAL									
A/C movmnts	12	13	1.0	13	27	21.5	31	34	1.9
Passengers	394	506	5.7	534	1,009	17.8	1,199	1,897	11.6
Frt tonnes	7	12	11.7	13	15	3.1	10	21	22.0
FARO PORTUGAL									
A/C movmnts	15	19	5.0	20	21	1.0	23	30	6.1
Passengers	912	1,495	12.8	1,687	2,440	8.9	2,629	3,509	6.7
Frt tonnes	1	1	0.0	1	2	20.0	2	3	10.0
PALMADE SPAIN									
A/C movmnts	73	75	0.5	75	97	5.9	97	118	4.3
Passengers	7,105	8,491	3.9	8,822	11,516	6.1	11,319	14,142	5.0
Frt tonnes	81	29	-12.9	26	21	-3.8	20	17	-3.0

MADRID	SPAIN								
A/C movmnts	129	117	-1.9	115	155	7.0	171	211	4.7
Passengers	10,037	10,539	1.0	10,644	14,246	6.8	15,869	18,427	3.2
Frt tonnes	158	185	3.4	191	233	4.4	250	213	-3.0
BASEL	SWISS								
A/C movmnts	84	90	1.4	91	44	-10.3	49	105	22.9
Passengers	834	980	3.5	1,014	1,543	10.4	1,777	2,150	4.0
Frt tonnes	28	16	-9.1	14	27	21.4	29	29	---
ZURICH	SWISS								
A/C movmnts	159	171	1.4	173	211	4.4	220	240	1.8
Passengers	7,446	8,786	3.6	9,102	11,653	5.6	12,277	14,538	3.7
Frt tonnes	164	214	6.1	227	274	4.1	271	337	4.9
COLOGNE	GERMANY								
A/C movmnts	38	48	4.9	50	85	14.0	97	121	4.9
Passengers	1,914	1,952	0.4	1,960	2,623	6.8	3,027	3,956	6.1
Frt tonnes	53	78	9.0	84	163	18.8	176	265	10.1
FRANKFURT	GERMANY								
A/C movmnts	210	220	1.0	223	300	6.9	311	364	3.4
Passengers	16,409	18,953	3.1	19,540	25,868	6.5	28,713	35,122	4.5
Frt tonnes	663	795	4.0	827	1,193	8.9	1,226	1,402	2.5
DUSSELDORF	GERMANY								
A/C movmnts	88	91	0.6	91	135	9.7	137	176	5.7
Passengers	6,899	7,727	2.4	7,912	10,405	6.3	11,559	13,995	4.2
Frt tonnes	39	43	2.1	44	51	3.2	52	54	0.8
NURENBURG	GERMANY								
A/C movmnts	16	23	7.7	24	36	10.0	41	75	16.6
Passengers	755	868	3.0	894	1,283	8.7	1,443	1,880	6.1
Frt tonnes	10	11	3.4	12	17	8.3	19	36	17.9
SAARBRUCKEN	GERMANY								
A/C movmnts	16	13	-3.6	12	15	5.0	13	13	---
Passengers	160	161	0.1	162	225	7.8	235	305	6.0
Frt tonnes	0	0	0.0	0	0	---	2	2	---
OSLO	NORWAY								
A/C movmnts	96	106	2.2	109	133	4.4	135	152	2.5
Passengers	3,493	4,855	7.8	5,233	6,442	4.6	6,356	9,345	9.4
Frt tonnes	---	---	---	54	59	1.9	67	69	0.6
AMSTERDAM	HOLLAND								
A/C movmnts	184	197	1.4	200	236	3.6	246	300	4.4
Passengers	9,170	10,958	3.9	11,385	15,338	6.9	16,198	23,559	9.1
Frt tonnes	326	432	6.5	461	610	6.5	630	874	7.7
ROTTERDAM	HOLLAND								
A/C movmnts	127	91	-5.7	86	108	5.1	111	114	0.5
Passengers	329	268	-3.7	258	275	1.3	297	360	4.2
Frt tonnes	11	2	-23.8	2	2	---	3	5	13.3
VIENNA	AUSTRIA								
A/C movmnts	82	83	0.3	83	103	4.8	110	153	7.8
Passengers	2,658	3,402	5.6	3,592	4,881	7.2	5,495	7,730	8.1
Frt tonnes	42	45	1.5	45	59	6.2	65	89	7.4
COPENHAGEN	DENMARK								
A/C movmnts	161	171	1.2	173	213	4.6	213	229	1.5
Passengers	8,425	9,225	1.9	9,400	11,622	4.7	11,787	13,330	2.6
Frt tonnes	165	172	0.9	174	158	-1.8	168	234	7.9
BRUSSELS	BELGIUM								
A/C movmnts	111	113	0.4	113	175	11.0	NR	226	---
Passengers	5,010	5,486	1.9	5,590	6,882	4.6	NR	11,342	---
Frt tonnes	173	177	0.4	177	323	16.5	NR	395	---

DUBLIN	IRELAND								
A/C movmnts	96	89	-1.6	87	113	6.0	NR	130	---
Passengers	2,579	2,579	0.0	2,579	5,086	19.4	NR	6,742	---
Frt tonnes	40	42	0.9	43	47	1.9	NR	60	---
TOULOUSE	FRANCE								
A/C movmnts	49	54	2.0	55	80	9.1	70	NR	---
Passengers	1,181	1,784	10.2	1,966	2,872	9.2	2,930	NR	---
Frt tonnes	13	17	6.4	18	27	10.0	29	NR	---
BORDEAUX	FRANCE								
A/C movmnts	65	60	-1.5	60	72	4.0	72	58	-3.9
Passengers	1,003	1,420	8.3	1,537	2,342	10.5	2,350	2,427	0.7
Frt tonnes	14	12	-3.6	11	15	7.3	14	18	5.7
MARSEILLES	FRANCE								
A/C movmnts	86	91	1.1	92	214	26.5	NR	100	---
Passengers	3,253	4,001	4,6	4,185	4,609	2.0	4,674	4,831	0.7
Frt tonnes	29	39	7.4	42	44	0.9	49	62	5.3
NICE	FRANCE								
A/C movmnts	65	83	5.4	88	132	10.0	142	127	-2.1
Passengers	2,839	3,747	6.4	3,987	5,436	7.3	5,475	6,212	2.7
Frt tonnes	17	19	2.0	20	29	9.0	31	31	---
HELSINKI	FINLAND								
A/C movmnts	88	87	-0,2	87	122	8.0	132	125	-1.1
Passengers	3,159	4,328	7.4	4,648	7,479	12.2	7,950	6,587	3.4
Frt tonnes	31	43	7.6	47	66	8.1	67	86	5.7

Appendix K-3

World Airports highest % annual growth
1980 - 1994 split into three 5 yr periods
passengers, freight tonnes & A/C movements)
(in 1000s)

Airport AsiaPacific	1980	1984	Average annual % increase	1985	1989	Average annual % increase	1990	1994	Average annual % increase
SEOUL	S. KOREA								
A/C movmnts	----	----	---	24	39	12.5	48	183	56.3
Passengers	3,506	5,627	12.1	6,307	13,878	24.0	16,821	27,333	12.5
Frt tonnes	182	312	14.3	357	607	14.0	644	1,029	12.0
SINGAPORE	SINGAPORE								
A/C movmnts	32	63	19.6	76	98	5.8	109	159	9.2
Passengers	3,307	7,078	22.8	8,692	12,973	9.8	14,406	21,644	10.0
Frt tonnes	123	307	30.1	399	587	9.4	630	1,026	12.6
BANGKOK	THAILAND								
A/C movmnts	53	73	7.6	79	117	9.6	120	160	6.7
Passengers	4,462	6,091	7.3	6,536	12,669	18.8	14,329	21,012	9.3
Frt tonnes	110	155	8.2	168	350	21.7	406	590	9.1
HONG KONG	HONG KONG								
A/C movmnts	----	----	---	74	112	10.3	123	160	6.0
Passengers	6,607	9,151	7.7	9,856	16,204	12.9	18,688	25,948	7.8
Frt tonnes	260	392	10.2	433	751	14.7	825	1,308	11.7
NEW TOKYO	JAPAN								
A/C movmnts	59	75	5.1	78	119	10.5	125	124	-0.2
Passengers	7,949	10,890	7.4	11,696	16,978	9.0	19,257	23,750	4.7
Frt tonnes	433	671	11.0	745	1,356	16.4	1,390	1,604	3.1
JAKARTA	INDONESIA								
A/C movmnts	NR	NR	--	62	90	9.0	92	141	10.6
Passengers	NR	NR	--	3,933	7,419	17.7	7,526	12,664	13.6
Frt tonnes	NR	NR	--	57	146	31.2	173	256	9.6
NADI	FIJI								
A/C movmnts	21	21	0.0	21	30	8.6	31	41	6.4
Passengers	483	575	3.8	597	694	3.2	785	941	4.0
Frt tonnes	7	8	4.9	9	13	8.9	14	19	7.1
PUSAN	S. KOREA								
A/C movmnts	NR	NR	--	NR	NR	---	44	52	3.6
Passengers	NR	NR	--	2,214	4,831	23.6	5,704	7,678	6.9
Frt tonnes	NR	NR	--	44	86	19.1	104	133	5.6

Appendix K-4

World Airports highest % annual growth
1980 - 1994 split into three 5 yr periods
passengers, freight tonnes & A/C movements)
(in 1000s)

Airport LatinAmerica/ Caribbean	1980	1984	Average annual % increase	1985	1989	Average annual % increase	1990	1994	Average annual % increase
CANCUN	MEXICO								
A/C movmnts	--	--	--	8.8	21.1	28	37.6	58.3	11.0
Passengers	728	1,194	12.8	1,369	1,958	8.6	2,962	4,428	9.9
Frt tonnes	2.7	3.7	7.4	4.1	6.8	13.2	8.0	--	--
GUADALAJARA	MEXICO								
A/C movmnts	--	--	--	75.5	37.1	-10.1	46.9	140.3	39.8
Passengers	2,666	2.920	1.9	2,977	3,153	1.2	3,508	5,283	10.1
Frt tonnes	10.0	16.7	13.4	19.2	17	2.3	22	--	--
MAZATLAN	MEXICO								
A/C movmnts	--	--	--	27.3	16.2	-8.1	16.5	27.1	12.8
Passengers	--	--	--	902	792	-2.4	826	673	-3.7
Frt tonnes	2.0	4.0	20.0	4.5	3.8	-3.1	3.8	--	--
P. VALLARTA	MEXICO								
A/C movmnts	--	--	--	24.0	17.6	-5.3	17.6	34.9	19.7
Passengers	880	1,100	5.0	1,155	1,381	3.9	1,426	1,613	2.6
Frt tonnes	2	3.0	10.0	3.3	2.8	-3.0	3.2	--	--
RIO	BRAZIL								
A/C movmnts	--	--	--	28.6	98.4	48.8	95	77.8	-3.6
Passengers	--	--	--	5,718	6,847	3.9	5,600	3,953	-5.9
Frt tonnes	99	166	13.5	188.4	216.4	3.0	148	153.6	0.8
QUITO	ECUADOR								
A/C movmnts	--	--	--	--	18.0	--	18.1	NR	--
Passengers	--	--	--	1,278	1,618	5.3	1,552	NR	--
Frt tonnes	15	26	14.7	30.2	15.1	-10	21.0	NR	--
SAO PAULO	BRAZIL								
A/C movmnts	--	--	--	73.4	100	7.2	151	123	-3.7
Passengers	--	--	--	4,206	6,738	12.0	5,775	7,701	6.7
Frt tonnes	--	--	--	38.4	318.6	145.9	362.8	379	0.9
CALI	COLOMBIA								
A/C movmnts	--	--	--	--	83.2	--	76.0	NR	--
Passengers	579	1,050	16.3	1,221	1,239	0.3	1,375	NR	--
Frt tonnes	--	11.5	--	15	26	14.7	40	NR	--

Appendix K-5

World Airports highest % annual growth
1980 - 1994 split into three 5 yr periods
passengers, freight tonnes & A/C movements)
(in 1000s)

Airport Africa	1980	1984	Av. annual % increase	1985	1989	Av. annual % increase	1990	1994	Av. annual % increase
MAPUTO	MOZAMBIQUE								
A/C movmnts	13	16	7.2	18	28	11.1	30	21	-6.0
Passengers	289	270	-1.7	265	339	5.6	373	355	-1.0
Frt tonnes	7	7	-0.7	7	4	-8.6	4	7	15.0
ILHADOSAL	CAPE VERDE								
A/C movmnts	7	7	0.2	7	7	---	7	8	2.9
Passengers	82	108	6.5	115	163	8.3	164	325	19.6
Frt tonnes	91	148	12.7	2	2	---	1	2	20.0
LUANDA	ANGOLA								
A/C movmnts	25	30	4.1	31	30	-0.6	28	NR	---
Passengers	651	1,078	13.1	1,220	1,437	3.6	1,334	NR	---
Frt tonnes	51	75	9.1	82	--	---	--	NR	---
KINSHASA	ZAIRE								
A/C movmnts	19	22	3.7	23	28	4.3	27	NR	---
Passengers	381	490	5.7	516	555	1.4	525	NR	---
Frt tonnes	39	75	18.8	89	89	---	77	NR	---
CAIRO	EGYPT								
A/C movmnts	NR	NR	--	58	79	7.2	81	NR	---
Passengers	NR	NR	--	6,235	7,516	4.1	7,159	NR	---
Frt tonnes	47	93	20.0	112	97	-2.7	103	NR	---
JERBA	TUNISIA								
A/C movmnts	NR	NR	--	5.2	6.9	6.5	6.9	NR	---
Passengers	434	491	2.6	504	673	6.7	650	NR	---
Frt tonnes	0.3	0.5	14.3	0.6	1.5	30.0	1.5	NR	---
MONASTIR	TUNISIA								
A/C movmnts	NR	NR	--	10	16.1	12.2	15	NR	---
Passengers	NR	NR	--	1,006	1,893	17.6	1,715	NR	---
Frt tonnes	0.9	2.3	32.7	3.1	1.5	-10.3	1.7	NR	---
SFAX	TUNISIA								
A/C movmnts	1.8	2.4	6.8	2.7	2.1	-4.4	3.6	4.1	2.8
Passengers	24	37	10.7	41	39	-1.0	42	77	16.7
Frt tonnes	0.3	1.2	53.0	1.8	0.3	-16.7	0.5	0.3	-8.0
TUNIS	TUNISIA								
A/C movmnts	27	27	-0.3	27	32	3.7	31	40	5.8
Passengers	1,661	1,960	3.6	2,030	2,314	2.8	2,150	2,847	6.5
Frt tonnes	16	17	2.2	18	23	5.5	27	23	-3.0
ADDIS ABABA	ETHIOPIA								
A/C movmnts	25	34	6.9	36	30	-3.3	37	NR	---
Passengers	170	288	12.7	325	NR	---	480	NR	---
Frt tonnes	12	32	31.0	41	NR	---	30	NR	---

Appendix K-6

World Airports highest % annual growth
1980 - 1994 split into three 5 yr periods
passengers, freight tonnes & A/C movements)
(in 1000s)

Airport Middle East	1980	1984	Av. annual % increase	1985	1989	Av. annual % increase	1990	1994	Av. annual % increase
TURKEY	ISTANBUL								
A/C movmnts	39	50	5.7	53	80	10.2	91	151	13.2
Passengers	1,879	3,063	12.6	3,505	NR	---	6,233	10,226	12.8
Frt tonnes	43	86	20.0	96	NR	---	85	121	8.5
MADRAS	INDIA								
A/C movmnts	16	22	7.0	23	27	3.5	31	34	1.9
Passengers	902	1,434	11.8	1,603	1,945	4.3	1,768	2,606	9.5
Frt tonnes	39	34	-3.0	33	45	7.3	43	69	12.1
BOMBAY	INDIA								
A/C movmnts	54	63	3.4	65	72	2.1	78	89	2.8
Passengers	4,342	6,600	10.4	7,286	8,293	2.8	7,968	9,955	5.0
Frt tonnes	95	161	14.4	184	220	3.9	199	214	1.5
CALCUTTA	INDIA								
A/C movmnts	NR	NR	--	27	30	2.2	27	25	-1.5
Passengers	1,270	1,734	7.3	1,860	2,418	6.0	2,164	2,335	1.6
Frt tonnes	18	29	12.0	32	41	5.6	38	41	1.6
N. DELHI	INDIA								
A/C movmnts	54	54	0.0	54	67	4.8	70	74	1.1
Passengers	2,762	4,171	10.2	4,596	5,959	5.9	5,407	6,524	4.1
Frt tonnes	65	107	12.8	121	143	3.6	135	177	6.2
KUWAIT	KUWAIT								
A/C movmnts	NR	NR	--	32	30	-1.3	NR	NR	---
Passengers	2,009	2,461	4.5	2,572	2,882	2.4	1,412	NR	---
Frt tonnes	46	70	10.1	77	85	2.1	46	NR	---
DHARAN	S. ARABIA								
A/C movmnts	NR	NR	--	42	27	-7.1	25	35	8.0
Passengers	NR	NR	--	3,538	2,532	-5.7	2,540	3,432	7.0
Frt tonnes	37	71	18.6	85	53	-7.5	55	59	1.4
COLOMBO	SRI LANKA								
A/C movmnts	NR	NR	--	83	NR	---	NR	21	---
Passengers	3,668	6,730	16.7	7,853	7,327	-1.3	7,466	2,151	-14.2
Frt tonnes	30	100	45.5	146	167	2.9	173	70	-11.9
JEDDAH	S.ARABIA								
A/C movmnts	NR	NR	--	83	NR	---	NR	77	---
Passengers	3,668	6,730	16.7	7,853	7,327	1.3	7,446	9,345	5.1
Frt tonnes	30	100	45.5	146	167	2.9	173	178	0.6

Appendix L

The emphasis here is on actual total weight permissible for safe take-offs. Therefore, the volume usable capacity becomes a neutral factor once the maximum total take-off weight of an aircraft is reached. For example : the maximum total take-off weight of the specially designed B747-200F freighter aircraft is 377.8 tonnes with a maximum net payload of 123.4 tonnes, and a maximum usable volume capacity of 682 cubic metres. In practice, the loadable capacity by weight and volume is calculated as follows:

1. Dry operating weight including the weight of the empty aircraft plus a maximum of 3000 kgs (3 tonnes) allowance for weight of three crew, their baggage, water and food supplies, emergency supplies, aircraft spares and other requirements including provisions for other airline staff to board the freighter. **Total 154.4 tonnes.**

2. Maximum zero fuel weight; means dry operating weight and maximum net payload at zero fuel in the tanks. Total **267.6 tonnes.**

3. The net payload becomes as follows :

Maximum zero fuel weight	267.6 tonnes
less dry operating weight	154.4 tonnes
Maximum net payload	113.2 tonnes

4. Fuel and oil total weight, at maximum net payload capacity becomes :

Total maximum take-off weight	377.8 tonnes
less zero fuel weight	267.6 tonnes
Total fuel/oil weight	110.2 tonnes

In actual weight terms, the weight of a litre of fuel depends on its density, ranging from 0.785 to 0.820 in relation to weather conditions such as temperature and level of humidity at the time of take-off. An average fuel density of 0.8 would mean that 1.250 litres is taken to equal 1 kg, or 1250 litres = 1 tonne. The B747-200F consumes 17,000 to 17,500 litres per block hour at full load with an average speed of 447 knots or 515 miles/hr. In tonnes it consumes 17,500 litres ÷ 1,250 = 14 tonnes per hour. At maximum net payload of 113.2 tonnes and maximum fuel/oil of 110.2 tonnes, the range becomes 110.2 tonnes ÷ 14, = 7 hours 52 minutes of flying time, which includes approximately 1 hour of fuel as reserve.

The maximum net weight payload is further precisely verified by the maximum landing weight of the aircraft B747-700F = 285.6 tonnes as detailed on the following page:

1.	Dry operating weight	154.4 tonnes
2.	Surplus trip range fuel of minimum 20 minutes	4.0 tonnes
3.	Reserve fuel of one hour	14.0 tonnes
4.	Net weight payload	113.2 tonnes
	Maximum landing weight	**285.6 tonnes**

The net weight payload is a factor of the maximum air sector range and fuel requirement. The longer the range, the more the fuel requirement at take-off and the lesser the net weight payload.

All the figures used in this analysis are declared by the manufacturers. The only disputable figures are those pertaining to maximum net payload and maximum usable volume capacity. The maximum total take-off weight of the aircraft cannot be increased due to structural limitations which also applies to floor load tolerance per square unit of measurement, i.e. per square meter or square foot. Each square section of the aircraft floor has a different permissible maximum load. The load must be spread with varying weights as per floor section limitations, and in order to maintain balance of the aircraft.

Questionnaires

Questionnaire for sea-air freight forwarders

ACCORDING TO THE BEST OF YOUR KNOWLEDGE, PLEASE TICK IN THE APPROPRIATE BOX. THIS QUESTIONNAIRE IS DESIGNED TO HELP PREPARE AN ACADEMIC STUDY ON SEA-AIR TRANSPORT. YOUR ASSISTANCE IS VERY HIGHLY APPRECIATED.

NAME & ADDRESS OF ORGANISATION:-

1. COUNTRY :____________________ CITY :____________________

2. ARE YOU A SEA-AIR OPERATOR?

   |__| YES |__| NO

3. WHEN DID YOUR COMPANY BEGIN USING SEA-AIR SERVICES?

   |__| WITHIN THE LAST 5 YEARS

   |__| WITHIN THE LAST 10 YEARS

   |__| FOR OVER 10 YEARS

4. DO YOU OFFER SHIPPERS/EXPORTERS?

   |__| SEA-AIR SERVICES, ALL INCLUSIVE COST DOOR TO DOOR

   |__| COST PER SERVICE OR PART THEREOF

5. DO YOU OFFER VARIOUS SEA-AIR TRANSFER POINTS?

   |__| YES |__| NO

6. DO YOU OFFER SEA-AIR SERVICES VIA?

a.	VANCOUVER	|__| YES	|__| NO
b.	SEATTLE	|__| YES	|__| NO
c.	LOS ANGELES	|__| YES	|__| NO
d.	SAN FRANCISCO	|__| YES	|__| NO
e.	SHARJAH, DUBAI, U.A.E.	|__| YES	|__| NO
f.	SINGAPORE	|__| YES	|__| NO
g.	VLADIVOSTOK	|__| YES	|__| NO
h.	HONGKONG	|__| YES	|__| NO

7. WHICH AIRPORT DO YOU UTILISE THE MOST?

____

____

9. WHICH SEA PORT DO YOU UTILISE THE MOST?

____

10. PLEASE SPECIFY THE ALTERNATE SEA PORT THAT YOU UTILISE.

____

11. DO YOU ISSUE SEA-AIR SCHEDULES?

|__| YES |__| NO

12. WHAT ATTRACTS THE SHIPPER?

|__| SHORT TRANSIT TIME

|__| COST INCENTIVES

|__| BOTH COST AND TIME

13. NATURE OF COMMODITIES, PERCENTAGE OF TOTAL VOLUME:

a) GARMENTS : __________ %

b) TEXTILES : __________ %

c) COMPUTERS (RELATED PARTS) : __________ %

d) FOOTWEAR : __________ %

e) ELECTRONIC PRODUCTS : __________ %

f) MISC. (COSMETICS, NOVELTIES, TOYS ETC. : __________ %

g) GEN. COMMODITIES VALUE OVER $ 4.00/KG : __________ %

h) GEN. COMMODITIES VALUE OVER $ 8.00/KG : __________ %

i) GEN. COMMODITIES VALUE OVER $ 12.00/KG : __________ %

j) GEN. COMMODITIES VALUE OVER $ 16.00/KG : __________ %

k) GEN. COMMODITIES VALUE OVER $ 20.00/KG : __________ %

14. CONCERN OF THE SHIPPER/SUPPLIER RE SEA-AIR SERVICES

a) IS DELIVERY TIME AT FINAL DESTINATION

|__| VERY IMPORTANT |__| IMPORTANT

|__| NOT IMPORTANT

b) IS TOTAL COST OF SEA-AIR SHIPPING TO FINAL DESTINATION

|__| VERY IMPORTANT |__| IMPORTANT

|__| NOT IMPORTANT

15. DOES THE SHIPPER/SUPPLIER EXPORT

|__| ONE MAJOR COMMODITY

|__| A VARIETY OF COMMODITIES OF THE SAME NATURE

|__| A VARIETY OF COMMODITIES OF A DIFFERENT NATURE

16. DO YOU THINK THAT SEA-AIR CARGO IS

|__| ORIGINALLY AIR CARGO

|__| ORIGINALLY SEA CARGO

|__| BOTH OF THE ABOVE

|__| ADDITIONAL TO THE ABOVE, DUE TO INCREASE IN TRADE

17. ORDERS ARE BY AIR, SOME SEA-AIR AND SOME OCEAN, DEPENDING ON

|__| DEMAND IN COUNTRY OF DESTINATION

|__| SEASONALITY OF COMMODITY

|__| INTRODUCTION OF A NEW COMMODITY

|__| TO SAVE ON STORAGE CHARGES AT CONSIGNEE MARKET

|__| ALL FOUR OF THE ABOVE REASONS

18. WHAT IN YOUR OPINION MAKES A SUPPLIER/SHIPPER CHOOSE TO USE DIRECT AIR FREIGHT, OR SEA-AIR OR ONLY OCEAN SHIPPING - DURING LAST YEAR?

|__| SPECIFIC INSTRUCTION FROM CONSIGNEE

|__| URGENCY OF ORDER NEED AT DESTINATION

|__| LETTER OF CREDIT TIME LIMIT

|__| SEASONALITY OF COMMODITY EXPORTED

|__| COMPETITION AT CONSIGNEE'S MARKET

|__| OTHERS, PLS. SPECIFY ______________________________

19. CONSIDERING DIRECT AIR FREIGHT FROM YOUR AREA TO NORTH, SOUTH & CENTRAL EUROPE?
OUT OF THE AIRPORT OF ______________________________

a) TO CENTRAL EUROPE:
AVERAGE COST PER KG

|__| US $ 1.00 |__| US $ 1.50

|__| US $ 1.25 |__| US $ 2.00

|__| OTHERS, PLS. SPECIFY ______________________________

AVERAGE COST PER KG

|__| US $ 1.00 |__| US $ 1.50

|__| US $ 1.25 |__| US $ 2.00

|__| OTHERS, PLS. SPECIFY ______________________

AVERAGE COST PER KG

|__| US $ 1.00 |__| US $ 1.50

|__| US $ 1.25 |__| US $ 2.00

|__| OTHERS, PLS. SPECIFY ______________________

c) TO SOUTH EUROPE:

AVERAGE COST PER KG

|__| US $ 1.00 |__| US $ 1.50

|__| US $ 1.25 |__| US $ 2.00

|__| OTHERS, PLS. SPECIFY ______________________

AVERAGE TRANSIT TIME

|__| 2 DAYS |__| 3 DAYS |__| 4 DAYS |__| 6 DAYS

|__| OTHERS,PLS. SPECIFY______________

20. CONSIDERING DIRECT CONTAINERISED SHIPPING FROM FAR EAST TO THE COUNTRY MAIN PORT:

a) EX JAPAN PORT OF ______________ TO: ______________

COST OF 20' CONTAINER: ________

COST OF 40' CONTAINER: ________

TRANSIT TIME : ________ DAYS

TERMINAL CHARGES: ________

DOCUMENTATION CHARGES: ________

FORWARDING CHARGES: ________

b) EX TAIWAN PORT OF ______________ TO: ______________

COST OF 20' CONTAINER: ________

COST OF 40' CONTAINER: ________

TRANSIT TIME : ________ DAYS

TERMINAL CHARGES: ________

DOCUMENTATION CHARGES: ________

c) EX S. KOREA PORT OF ____________ TO: ____________

COST OF 20' CONTAINER: ________

COST OF 40' CONTAINER: ________

TRANSIT TIME : ________ DAYS

TERMINAL CHARGES: ________

DOCUMENTATION CHARGES: ________

FORWARDING CHARGES: ________

d) EX HONG KONG PORT OF ____________ TO: ____________

COST OF 20' CONTAINER: ________

COST OF 40' CONTAINER: ________

TRANSIT TIME : ________ DAYS

TERMINAL CHARGES: ________

DOCUMENTATION CHARGES: ________

FORWARDING CHARGES: ________

21. AVERAGE RATE PER KG IN US $ FROM THE FOLLOWING AIRPORTS TO THE FOLLOWING DESTINATIONS

FROM: VANCOUVER:

TO	PER 100 KG	PER 250 KG	PER 500 KG
AMS			
BRU			
CPH			
OSL			
STO			
MAD			
BCN			
HEL			
LIS			
PAR			
LON			
FRA			
ROM			
SNN			
GLA			

FROM: SEATTLE:

TO	PER 100 KG	PER 250 KG	PER 500 KG
AMS			
BRU			
CPH			
OSL			
STO			
MAD			
BCN			
HEL			
LIS			
PAR			
LON			
FRA			

FROM: LOS ANGELES:

TO	PER 100 KG	PER 250 KG	PER 500 KG
AMS			
BRU			
CPH			
OSL			
STO			
MAD			
BCN			
HEL			
LIS			
PAR			
LON			
FRA			
ROM			
SNN			
GLA			

FROM: SAN FRANCISCO:

TO	PER 100 KG	PER 250 KG	PER 500 KG
AMS			
BRU			
CPH			
OSL			
STO			
MAD			
BCN			
HEL			
LIS			
PAR			
LON			
FRA			
ROM			
SNN			
GLA			

22. DO YOU EXPERIENCE BACKLOGS AT THE AIRPORT OF ORIGIN

|__| YES |__| NO

23. IF YES IS IT BECAUSE OF

|__| LIMITED CARGO FLIGHTS

|__| INCREASE OF SEA-AIR VOLUME

|__| LIMITED AIRPORT FACILITIES

|__| INCREASED VOLUME OF LOCAL PRODUCTS FOR EXPORT

24. IN CASE OF BACKLOGS DO YOU

|__| DIVERT THE CARGO TO OTHER AIRPORTS

|__| WAIT FOR OTHER CARGO FLIGHT SPACE

|__| CO-LOAD WITH ANOTHER AGENT

25. DO YOU WAIT FOR SPACE TILL IT IS AVAILABLE?

26. IF YES HOW MANY DAYS ON AN AVERAGE DO YOU WAIT?

a) ____________ DAYS

DO YOU PAY THE AIRPORT DEMURRAGE CHARGES IN CASE OF DELAY?

b) |__| YES |__| NO

c) IF YES HOW MUCH PER 100 KG

____________ US $ PER 100 KG

27. IN CASE OF DELAY DUE TO SPACE LIMITATIONS, DO YOU RECEIVE A CLAIM FROM CONSIGNEE/SHIPPER

|__| YES |__| NO

IF YES HOW MUCH DO THEY CLAIM FOR A DAY PER 100 KG

____________ US $ PER 100 KG

29. DO YOU BOOK CARGO ON RELEVANT AIRLINES, TO POINTS IN EUROPE

1 TO 5 DAYS IN ADVANCE |__|

2 TO 10 DAYS IN ADVANCE |__|

3 TO 15 DAYS IN ADVANCE |__|

OTHERS, PLS. SPECIFY ______________________________

30. PLS. NAME THE QUARTER OF THE YEAR WHEN SPACE TO EUROPE IS VERY TIGHT

|__| 1ST QUARTER |__| 2ND QUARTER

|__| 3RD QUARTER |__| 4TH QUARTER

31. IN CASE OF NO SPACE BEING AVAILABLE TO EUROPE, WHAT DO YOU DO?

____

32. WHAT PERIOD OF THE YEAR SHOWED PEAK VOLUME

|__| 1ST QUARTER |__| 2ND QUARTER

|__| 3RD QUARTER |__| 4TH QUARTER

33. HOW DO YOU TRANSPORT YOUR SEA-AIR CARGO

|__| REGULAR CARGO FLIGHTS

|__| REGULAR PAX FLIGHTS

|__| COMBI FLIGHTS

|__| CHARTER CARGO FLIGHTS

34. DURING THE LAST 2 YR., WHAT % OF SEA-AIR CARGO WAS TRANSPORTED

BY REGULAR CARGO FLTS_______ % BY REGULAR PAX FLTS _______ %

35. WHO DOES THE UNLOADING FROM THE SHIPPING LINE CONTAINERS TO THE AIRPORT WAREHOUSE?

|__| AIRPORT STAFF |__| HANDLING AGENT

|__| YOUR OWN STAFF |__| AIRLINE

36. WHO DOES THE PALLETISATION?

|__| HANDLING AGENTS |__| AIRLINE

|__| YOUR OWN STAFF |__| OTHERS PLS. SPECIFY ____________

37. HOW LONG DOES THE SEA-AIR CARGO REMAIN IN TRANSIT?

|__| LESS THAN 6 HRS |__| BETN. 6 & 12 HRS

|__| MORE THAN 12 HRS |__| OTHERS - PLS. SPECIFY

38. HANDLING OF SEA & AIR SHIPMENT

a) DOES THE CARGO ARRIVE STRICTLY IN CONTAINERS

|__| YES |__| NO

b) WHAT PERCENTAGE OF IT IN 20'CONTAINERS __________ %

c) WHAT PERCENTAGE IN 40' CONTAINERS __________ %

d) WHAT PERCENTAGE OF IT IN OTHERS, __________ %

PLS. SPECIFY ______________________________

39. IF SHIPMENT ARRIVES STRICTLY IN CONTAINERS, THEN WHAT %:

a) FCL ________ % b) LCL ________ % c) OTHERS ________ %

40. WHAT DOCUMENTS ARE NEEDED TO CUSTOM CLEAR SEA-AIR SHIPMENT FROM THE PORT TO THE AIRPORT

|__| PACKING LIST + INVOICE + ORIGINAL B/L

|__| INVOICE + ORIGINAL B/L

|__| COMBINED TRANSPORT DOCUMENTS (CTD)

|__| OTHERS, PLS. SPECIFY ______________________________

41. HOW DOES SEA-AIR SHIPMENT MOVE IN TRANSIT FROM PORT TO AIRPORT WITHOUT PAYING ENTRY DUTIES BY:

|__| BANK GUARANTEE TO CUSTOMS AUTHORITY

|__| FORWARDERS GUARANTEE TO CUSTOMS AUTHORITY

|__| CUSTOMS HOUSE BROKER GUARANTEE

|__| OTHER MEANS, PLS. SPECIFY ______________________________

42. DURING THE HANDLING OF SEA-AIR CARGO IN THE LAST TWO YEARS, DID YOU EXPERIENCE

a) ARRIVAL OF DAMAGED CARGO ________ %

b) DAMAGE IN TRANSIT ________ %

c) THEFT ________ %

d) VOLUME/WEIGHT DISRUPTION ________ %

43. HOW DO YOU RATE FACILITIES OF AIRPORTS AND SEA PORTS AS SEA-AIR INTERCHANGE HUB?

a) AIRPORT

1. ________________ |__| GOOD |__| V GOOD |__| EXCELLENT

2. ________________ |__| GOOD |__| V GOOD |__| EXCELLENT

3. ________________ |__| GOOD |__| V GOOD |__| EXCELLENT

b) SEA PORT

1. ________________ |__| GOOD |__| V GOOD |__| EXCELLENT

2. ________________ |__| GOOD |__| V GOOD |__| EXCELLENT

3. ________________ |__| GOOD |__| V GOOD |__| EXCELLENT

44. BEING A SEA-AIR OPERATOR WOULD YOU LIKE TO SEE

|__| FLAT RATE FOR SEA-AIR CARGO

|__| COMMODITY RATE

|__| FIXED RATE FOR FIXED PERIODS

|__| OTHERS; PLS. SPECIFY ________________________________

45. IN YOUR OPINION HOW COULD SEA-AIR DEVELOP FURTHER?

Questionnaire for Far East sea-air freight forwarders

ACCORDING TO THE BEST OF YOUR KNOWLEDGE, PLEASE TICK IN THE APPROPRIATE BOX. THIS QUESTIONNAIRE IS DESIGNED TO HELP PREPARE AN ACADEMIC STUDY ON SEA-AIR TRANSPORT. YOUR ASSISTANCE IS VERY HIGHLY APPRECIATED.

NAME & ADDRESS OF ORGANISATION:-

1. COUNTRY :____________________ CITY :______________________

2. DO YOU OFFER SHIPPERS/EXPORTERS?

   |__| SEA-AIR SERVICE, ALL INCLUSIVE COST DOOR TO DOOR

   |__| COST PER SERVICE, OR PART THEREOF

3. DO YOU OFFER VARIOUS SEA-AIR TRANSFER POINTS?

   |__| YES |__| NO

4. DO YOU OFFER SEA-AIR SERVICES VIA?

1.	SEATTLE	|__| YES	|__| NO
2.	LOS ANGELES	|__| YES	|__| NO
3.	SINGAPORE	|__| YES	|__| NO
4.	VLADIVOSTOK	|__| YES	|__| NO
5.	U.A.E.	|__| YES	|__| NO

5. CONSIDERING SEA-AIR SERVICES FROM YOUR AREA TO EUROPE VIA DIFFERENT SEA-AIR HUBS:

Port of Origin Europe	Via	Cost (US$)	Transit time (to final destination)	Destinantion points
	Seattle			
	Los Angeles			
	Singapore			
	Vladivostok			
	U.A.E.			

6. CONSIDERING DIRECT CONTAINERIZED SHIPPING FROM FAR EAST TO THE SEA-AIR HUB: EX PORT OF ________________

To	Western Europe	Scandinavian countries	Portugal/Spain
Cost of 20' container (US$)			
Cost of 40' container (US$)			
Transit time (days)			
Documentation charges			
Forwarders charges			

7. DO YOU USE SEA-AIR SCHEDULES?

|__| YES |__| NO

8. RANK THE FOLLOWING IN ORDER OF ATTRACTIVENESS TO THE SUPPLIER?

|__| SHORT TRANSIT TIME

|__| LOWER TRANSPORTATION COST

|__| LOWER INSURANCE COST

|__| FLEXIBILITY

|__| SHORT TRANSIT TIME & LOWER TRANSPORTATION COST

9. NATURE OF COMMODITIES, PERCENTAGE OF TOTAL VOLUME:

a) GARMENTS : ____________ %

b) TEXTILES : ____________ %

c) COMPUTERS (RELATED PARTS) : ____________ %

d) FOOTWEAR : ____________ %

e) ELECTRONIC PRODUCTS : ____________ %

f) MISC. (COSMETICS, NOVELTIES, TOYS ETC.: ____________ %

g) GEN. COMMODITIES VALUE OVER $ 4.00/KG : ____________ %

h) GEN. COMMODITIES VALUE OVER $ 8.00/KG : ____________ %

i) GEN. COMMODITIES VALUE OVER $ 12.00/KG : ____________ %

j) GEN. COMMODITIES VALUE OVER $ 16.00/KG : ____________ %

k) GEN. COMMODITIES VALUE OVER $ 20.00/KG : ____________ %

10. CONCERN OF THE SHIPPER/SUPPLIER RE SEA-AIR SERVICES

a) IS DELIVERY TIME AT FINAL DESTINATION

|__| VERY IMPORTANT

|__| IMPORTANT

|__| NOT IMPORTANT

b) IS TOTAL COST OF SEA-AIR SHIPPING TO FINAL DESTINATION

|__| VERY IMPORTANT

|__| IMPORTANT

|__| NOT IMPORTANT

11. IF THERE WERE NO SEA-AIR SERVICES, HOW WOULD THE BULK OF CARGO TRAVEL?

|__| BY AIR |__| BY SEA |__| BOTH AIR & SEA

12. FOR THE ORDERS OF SEA-AIR PLS. RANK THE FOLLOWING IN ORDER OF IMPORTANCE

|__| DEMAND IN COUNTRY OF DESTINATION

|__| INTRODUCTION OF A NEW COMMODITY

|__| TO SAVE ON STORAGE CHARGES AT CONSIGNEE MARKET

|__| SPECIFIC INSTRUCTION FROM CONSIGNEE

|__| URGENCY OF ORDER NEED AT DESTINATION

|__| LETTER OF CREDIT TIME LIMIT

|__| SEASONALITY OF COMMODITY EXPORTED

|__| COMPETITION AT CONSIGNEE'S MARKET

13. CONSIDERING DIRECT AIR FREIGHT FROM YOUR AREA TO EUROPE, OUT OF THE AIRPORT ______________________

A) TO WESTERN EUROPE (AVERAGE COST/KG IN $):

HIGH RATE ____________ LOW RATE ____________

B) TO SCANDINAVIAN COUNTRIES (AVERAGE COST/KG IN $):

HIGH RATE ____________ LOW RATE ____________

C) TO PORTUGAL & SPAIN (AVERAGE COST/KG IN $):

HIGH RATE ____________ LOW RATE ____________

14. DO YOU EXPERIENCE BACKLOGS AT THE AIRPORT OF ORIGIN TO EUROPE?

|__| YES |__| NO

15. IF YES IS IT BECAUSE OF :

|__| LIMITED CARGO FLIGHTS

|__| LIMITED CARGO CAPACITY

|__| LIMITED AIRPORT CAPACITY

16. PLS. NAME THE QUARTER OF THE YEAR WHEN SPACE TO EUROPE IS VERY TIGHT

|__| 1ST QUARTER |__| 2ND QUARTER

|__| 3RD QUARTER |__| 4TH QUARTER

17. BEING A SEA-AIR OPERATOR WOULD YOU LIKE TO SEE

|__| FLAT RATE FOR SEA-AIR CARGO

|__| COMMODITY RATE

|__| FIXED RATE FOR FIXED PERIODS

|__| OTHERS, PLS. SPECIFY

18. IN YOUR OPINION HOW COULD SEA-AIR DEVELOP FURTHER?

Questionnaire for importers using sea-air

ACCORDING TO THE BEST OF YOUR KNOWLEDGE, PLEASE TICK IN THE APPROPRIATE BOX. THIS QUESTIONNAIRE IS DESIGNED TO HELP PREPARE AN ACADEMIC STUDY ON SEA-AIR TRANSPORT. YOUR ASSISTANCE IS VERY HIGHLY APPRECIATED.

NAME & ADDRESS OF ORGANISATION:-

----

1. WHEN DID YOUR COMPANY BEGIN USING SEA-AIR SERVICES?

|__| WITHIN THE LAST 5 YEARS

|__| WITHIN THE LAST 10 YEARS

|__| FOR OVER 10 YEARS

2. WHAT ARE YOUR REASONS FOR USING SEA-AIR? PLEASE RANK IN ORDER OF ATTRACTIVENESS :

|__| SHORT TRANSIT TIME

|__| LOWER TRANSPORTATION COST

|__| LOWER INSURANCE

|__| SAVINGS ON STORAGE/STOCK PILING

|__| SHORT TRANSIT TIME AND LOWER TRANSPORTATION COST

3. NATURE OF COMMODITIES, PERCENTAGE OF TOTAL VOLUME:

a) GEN. COMMODITIES VALUE LESS THAN $ 4.00/KG : ______________ %

b) GEN. COMMODITIES VALUE OVER $ 4.00/KG : ______________ %

c) GEN. COMMODITIES VALUE OVER $ 8.00/KG : ______________ %

d) GEN. COMMODITIES VALUE OVER $ 12.00/KG : ______________ %

e) GEN. COMMODITIES VALUE OVER $ 16.00/KG : ______________ %

4. IS TOTAL COST OF SEA-AIR SHIPPING TO FINAL DESTINATION :

|__| VERY IMPORTANT |__| IMPORTANT |__| NOT IMPORTANT

5. IS DELIVERY TIME AT FINAL DESTINATION

|__| VERY IMPORTANT |__| IMPORTANT |__| NOT IMPORTANT

6. FOR SEA-AIR ORDERS PLEASE RANK THE FOLLOWING IN THEIR ORDER OF IMPORTANCE :

|__| DEMAND IN COUNTRY OF DESTINATION

|__| INTRODUCTION OF A NEW COMMODITY

|__| TO SAVE ON STORAGE CHARGES

|__| URGENCY OF ORDER NEED AT DESTINATION

|__| LETTER OF CREDIT TIME LIMIT

|__| SEASONALITY OF COMMODITY IMPORTED

|__| COMPETITION AT YOUR MARKET

7. HOW MANY SEA-AIR SHIPMENTS DO YOU HAVE PER YEAR?

|__| 5 SHIPMENTS |__| 10 SHIPMENTS

|__| MORE THAN 10 SHIPMENTS: PLS. SPECIFY ________________

____

8. WHAT IS THE AVERAGE SIZE OF YOUR SEA-AIR SHIPMENTS?

|__| 300 KGS |__| 500 KGS

|__| MORE THAN 500 KGS : PLS. SPECIFY ________________

____

9. AS SEA-AIR SHIPMENT ARRIVES AT DESTINATION AIRPORT, CLEARANCE AND DELIVERY TO YOUR DOOR OR WAREHOUSE :

|__| SAME DAY (EXCEPT WEEKENDS) |__| 2 DAYS

|__| MORE THAN 2 DAYS

10. ACCORDING TO YOUR EXPERIENCE, AVERAGE SEA-AIR TRANSIT TIME FROM THE FAR EAST TO YOUR DOOR :

|__| 16 DAYS |__| 18 DAYS |__| 20 DAYS

11. HAVING SET AN AVERAGE TIME, HOW FREQUENT ARE THE DELAYS TO THE ABOVE AVERAGE :

|__| ONCE PER YEAR |__| TWICE A YEAR

|__| MORE THAN TWICE A YEAR; PLS. SPECIFY: ________________

____

12. HOW LONG ARE THE DELAYS ?

|__| 1 -2 DAYS |__| 3 - 4 DAYS |__| MORE THAN 4 DAYS

13. PLEASE NAME THE QUARTER OF THE YEAR WHICH SHOWED PEAK VOLUME

|__| 1ST QUARTER |__| 2ND QUARTER

|__| 3RD QUARTER |__| 4TH QUARTER

14. DOES THE SEA-AIR CONCEPT HELP YOUR DISTRIBUTION SYSTEM

|__| SAVING ON STORAGE

|__| DIRECT DELIVERIES TO YOUR CLIENTS

|__| NONE OF THE ABOVE

IF YES, THEN IS IT :

|__| VERY IMPORTANT |__| IMPORTANT |__| NOT IMPORTANT

15. IF THERE WERE NO SEA-AIR SERVICES, HOW WOULD YOU IMPORT YOUR CARGO?

|__| BY AIR |__| BY SEA |__| BOTH OF THE ABOVE

PLEASE SPECIFY THE REASON:

----

16. WHEN WOULD YOU USE SEA-AIR SERVICES - PLEASE RANK THE FOLLOWING IN THE ORDER OF ATTRACTIVENESS :

|__| WHEN TRANSPORTATION COST IS HALF OF DIRECT AIR

|__| WHEN TRANSIT TIME IS HALF THAT OF SHIPPING LINES

|__| WHEN THERE IS INSUFFICIENT AIR CAPACITY AT ORIGIN

17. IN YOUR OPINION SEA-AIR COST IS :

|__| LESS THAN DIRECT AIR BY 25%

|__| LESS THAN DIRECT AIR BY 50%

|__| OTHERS, PLEASE SPECIFY ______________________________

____

18. IN YOUR OPINION SEA-AIR TRANSIT TIME IS :

|__| FASTER THAN SHIPPING LINES BY 25%

|__| FASTER THAN SHIPPING LINES BY 50%

|__| OTHERS, PLEASE SPECIFY ______________________________

____

19. IN YOUR OPINION WHAT PERCENTAGE OF COST AND TRANSIT TIME MAKES YOU DECIDE ON USE OF SEA-AIR ?

COST IN RELATION TO DIRECT AIR __________ % LESS

TRANSIT TIME IN RELATION TO ALL SEA __________ % LESS

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Questionnaire for sea-air sea port hub

ACCORDING TO THE BEST OF YOUR KNOWLEDGE, PLEASE TICK IN THE APPROPRIATE BOX. THIS QUESTIONNAIRE IS DESIGNED TO HELP PREPARE AN ACADEMIC STUDY ON SEA-AIR TRANSPORT. YOUR ASSISTANCE IS VERY HIGHLY APPRECIATED.

NAME & ADDRESS OF PORT:-

1. COUNTRY :________________ CITY :________________

2. MANAGEMENT :

   a) GOVERNMENT DEPARTMENT AUTHORITIES |__| YES |__| NO

   b) PRIVATE |__| YES |__| NO

   c) OTHERS |__| YES |__| NO

3. HOURS OF OPERATION

   |__| 24 HRS |__| 18 HRS |__| LESS THAN 18 HRS

4. DO YOU HAVE A SEA-AIR CARGO DEPT.?

   |__| YES |__| NO

   IF YES, PLS. SUPPLY THE FOLLOWING DETAILS

   NUMBER OF STAFF :________________

   WHEN ESTABLISHED :________________

   NUMBER OF SALES REPS SELLING SEA-AIR METHOD :________________

5. HOW DO THEY MARKET SEA-AIR CARGO TRANSPORTATION?

   |__| BY ATTRACTING NEW SERVICES

   |__| BY PROVIDING SPECIAL RATES & CHARGES

   |__| BY GIVING INCENTIVES TO FREIGHT FORWARDERS

6. WHO DOES THE HANDLING?

|__| SEA PORT AUTHORITY

|__| SHIPPING LINE

|__| PRIVATE COMPANIES

|__| OTHERS

7. DO YOU HAVE SEA-AIR STATISTICS ?

|__| YES |__| NO

IF YES THEN BY

|__| DESTINATION |__| COMMODITY |__| VOLUME

8. WHO CONTROLS THE SEA PORT WAREHOUSE?

|__| SEA PORT MANAGEMENT

|__| HANDLING AGENT

|__| SHIPPING LINE

|__| FORWARDERS

9. DO YOU SUPERVISE LOADING/UNLOADING OF SEA-AIR CARGO?

|__| YES |__| NO

10. IF NO WHO PROVIDES THE SERVICE

|__| HANDLING AGENT

|__| SEA-AIR FORWARDERS/OPERATORS

|__| SHIPPING LINE

|__| OTHERS

11. DOES THE FORWARDER HAVE ACCESS TO THE WAREHOUSE AT SEA PORTS?

|__| YES |__| NO

12. WHO CERTIFIES NO OF PIECES PER SHIPMENT

a) HANDLING AGENT |__| YES |__| NO

b) FORWARDER |__| YES |__| NO

c) SEA PORT AUTHORITY |__| YES |__| NO

d) OTHERS |__| YES |__| NO

13. HOW LONG DOES IT TAKE TO TRANSPORT THE CONTAINER FROM SEA PORT TO MAIN AIRPORT?

|__| 1 TO 4 HOURS

|__| 4 TO 6 HOURS

|__| 6 TO 12 HOURS

14. HOW FAR IS THE SEA PORT - WHICH HANDLES THE SEA-AIR CARGO - FROM THE AIRPORT?

|__| LESS THAN 10 MILES

|__| BETWEEN 10 & 20 MILES

|__| BETWEEN 20 & 40 MILES

|__| BETWEEN 40 & 60 MILES

|__| MORE THAN 60 MILES

15. FOR HOW LONG DOES THE SEA-AIR CARGO REMAIN IN TRANSIT?

|__| LESS THAN 6 HRS

|__| BETWEEN 6 AND 12 HRS

|__| MORE THAN 12 HRS

|__| OTHERS

16. HANDLING OF SEA-AIR SHIPMENT

A) ARRIVAL OF CARGO
a) DOES THE CARGO ARRIVE STRICTLY IN CONTAINERS

|__| YES |__| NO

b) WHAT PERCENTAGE OF IT IS IN 20' CONTAINER : ____________ %

c) WHAT PERCENTAGE IN 40' CONTAINER : ____________ %

d) WHAT PERCENTAGE IN OTHERS (PLS. SPECIFY) : ____________ %

17. IF CARGO ARRIVES STRICTLY IN CONTAINERS, THEN WHAT PERCENTAGE

a) FCL ________ % b) LCL ________ % c) OTHERS ________ %

18. SEA-AIR VOLUME IN TONNES

a) 1988 ___________ b) 1989 _______________

c) 1990 ___________ d) 1991 _______________

19. NATURE OF COMMODITIES, PERCENTAGE OF TOTAL VOLUME:

a) GARMENTS : ______ %

b) TEXTILES : ______ %

c) COMPUTERS (RELATED PARTS) : ______ %

d) FOOTWEAR : ______ %

e) ELECTRONIC PRODUCTS : ______ %

f) OTHERS SUCH AS COSMETICS, NOVELTIES, TOYS ETC.: ______ %

20. WHAT IS THE FREIGHT CAPACITY AVAILABLE AT YOUR MAIN SEA PORT?

21. IF THERE WAS ANY INCREASE, WAS IT BECAUSE OF SEA-AIR?

|__| YES |__| NO

22. ONCE SEA-AIR CARGO REACHES THE MAIN SEA PORT TERMINAL:

a) DO YOU TRANSPORT IT TO AIRPORTS

b) TO WAREHOUSE

23. IF TO WAREHOUSE THEN WHAT IS

a) AVERAGE TIME IN WAREHOUSE ________

b) WAREHOUSE FREE TIME ALLOWED BY SEA PORT AUTHORITIES

|__| 6 - 12 HRS |__| 12 - 24 HRS

|__| 24 - 48 HRS |__| MORE THAN 72 HRS (PLS. SPECIFY)

24. WHAT DEMURRAGE CHARGE AFTER FREE TIME ALLOWANCE

|__| PER TONNE |__| PER CBM

|__| PER TEU |__| OTHERS (PLS. SPECIFY)

25. IF YOU CHARGE DEMURRAGE DID YOU INCREASE THE CHARGES DURING THE LAST 4 YEARS?

|__| YES |__| NO

26. IF YES THEN BY WHAT PERCENTAGE?

1991 ________ %

1990 ________ %

1989 ________ %

1988 ________ %

27. WHAT PERIOD OF THE YEAR SHOWED THE HIGHEST YIELD FROM DEMURRAGE:

|__| 1ST QUARTER |__| 2ND QUARTER

|__| 3RD QUARTER |__| 4TH QUARTER

28. WHO CUSTOM CLEARS SEA-AIR CARGO?

|__| LICENSED CUSTOM HOUSE BROKER |__| LICENSED FRT FORWARDER

|__| SHIPPING LINE |__| AIRLINE

|__| OTHERS PLS. SPECIFY ________________________________

29. WHAT DOCUMENTS ARE NEEDED TO CUSTOM CLEAR SEA-AIR CARGO PORT TO AIRPORT

|__| PACKING LIST + INVOICE + B/L ORIGINAL

|__| INVOICE + B/L ORIGINAL

|__| PACKING LIST + B/L ORIGINAL

|__| COMBINED TRANSPORT DOCUMENTS

|__| OTHERS PLS. SPECIFY ________________________________

30. HOW DOES SEA-AIR CARGO MOVE IN TRANSIT FROM PORT TO AIRPORT WITHOUT PAYING ENTRY DUTIES BY:

|__| BANK GUARANTEE TO CUSTOMS AUTHORITY

|__| FORWARDERS GUARANTEE TO CUSTOMS AUTHORITY

|__| CUSTOMS HOUSE BROKER GUARANTEE

|__| OTHER MEANS, PLS. SPECIFY ________________________________

31. DURING WHAT HOURS OF THE DAY SHOULD TRANSIT CUSTOMS CLEARANCE BE DONE

|__| BETWEEN 8.00 AM - 5.00 PM

|__| BETWEEN 8.00 AM - 12 MIDNIGHT

|__| AFTER 5.00 PM AT AN EXTRA COST OF US$ _______ PER HOUR

|__| OTHERS, PLS. SPECIFY ______________________________

32. KINDLY LIST THE MAJOR SHIPPING LINES CALLING AT YOUR PORT EX FAR EAST PER FORTNIGHT:

1.	6.
2.	7.
3.	8.
4.	9.
5.	10.

33. SHIPPING LINES CALLING DIRECT (NON-STOP) FROM THE FAR EAST TO YOUR PORT PER FORTNIGHT:

a) NUMBER _______

b) NAMES :

1.	6.
2.	7.
3.	8.
4.	9.
5.	10.

c) AVERAGE NO. OF DAYS PER TRIP FROM CLOSING TIME:

1. KOREA
2. JAPAN
3. TAIWAN
4. HONGKONG
5. SINGAPORE
6. OTHERS

34. SHIPPING LINES CALLING VIA VANCOUVER OR WITH ONE OR MORE STOPS PER TRIP PER FORTNIGHT.

a) NUMBER __________

b) NAMES OF SHIPPING LINES

1. 6.
2. 7.
3. 8.
4. 9.
5. 10.

35. WHICH PERIOD OF THE YEAR WITNESSES THE HIGHEST CONGESTION

|__| 1ST QUARTER |__| 2ND QUARTER

|__| 3RD QUARTER |__| 4TH QUARTER

36. WHAT IS THE AVERAGE DELAY PER ANNUM IN DAYS BEFORE ACTUAL BERTHING

|__| 1 - 2 DAYS |__| 3 - 5 DAYS

|__| 6 - 7 DAYS |__| MORE THAN 7 DAYS

37. IS IT BECAUSE OF

a) LIMITED CAPACITY? |__| YES |__| NO

b) INCREASE OF SEA-AIR VOLUME |__| YES |__| NO

c) INCREASE OF NORMAL CARGO |__| YES |__| NO

38. DO YOU DIVERT BACKLOGS TO OTHER SEA PORTS

|__| YES |__| NO

38. IF YES HOW FAR IS THE OTHER SEA PORT

|__| 0 - 50 MILES |__| 50 - 100 MILES

|__| MORE THAN 100 MILES

40. WHAT IS THE AVERAGE CAPACITY PER SHIP

|__| 1000 TEUS |__| 1200 TEUS

|__| 1300 TEUS |__| MORE THAN 1300 TEUS

41. HOW LONG DOES IT TAKE TO OFF LOAD 1300 TEUS AND MOVE TO THE PORT WAREHOUSE

|__| 12 - 24 HRS |__| 24 - 48 HRS

|__| 48 - 72 HRS |__| MORE THAN 72 HRS

42. ARE SHIPPING LINES IN GENERAL FULLY AWARE OF THE SEA-AIR CARGO MOVEMENT

|__| YES |__| NO

43. IF YES, WHAT STEPS AND MEASURES HAVE THEY TAKEN TO ENCOURAGE AND FACILITATE THIS MOVEMENT

a) DO THEY LOAD SEA-AIR CONTAINER LAST, AT ORIGIN IN ORDER TO OFF LOAD FIRST AT POINT OF DESTINATION

|__| YES |__| NO

b) RANDOM LOADING AT ORIGIN

|__| YES |__| NO

44. DO SHIPPING LINES OFF LOAD SEA-AIR CONTAINERS

a. ON PRIORITY BASIS

|__| YES |__| NO

b. ON PRIORITY IF REQUESTED BY THE FORWARDER

|__| YES |__| NO

c. IN CASE OF PRIORITY OFF LOADING, AT WHAT ADDITIONAL COST

US$ ______ PER TEUS |__| NO CHARGE

|__| OTHERS - PLS. SPECIFY

45. WHO HANDLES LCL SEA-AIR CARGO

|__| SHIPPING LINE |__| FORWARDERS

|__| OTHERS - PLS. SPECIFY

46. WHO BREAK-BULK SEA-AIR LCL CARGO:

|__| SHIPPING LINE |__| FORWARDERS

|__| OTHERS - PLS. SPECIFY

47. ARE PORT AUTHORITIES FULLY AWARE OF THE TIME ELEMENT REQUIRED fOR THE SEA-AIR CARGO MOVEMENT

|__| YES |__| NO

48. WHAT STEPS OR MEASURES ARE ADOPTED TO IMPROVE ON MOVEMENT

|__| LONGER WORKING HRS |__| ADDITIONAL SHIFTS

|__| OTHERS - PLS. SPECIFY

49. IN CASE OF ADDITIONAL WORKING HRS

US$ _______ MORE PER TEUS |__| NO CHARGE

|__| OTHERS - PLS. SPECIFY

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Questionnaire for sea-air airport hub

ACCORDING TO THE BEST OF YOUR KNOWLEDGE, PLEASE TICK IN THE APPROPRIATE BOX. THIS QUESTIONNAIRE IS DESIGNED TO HELP PREPARE AN ACADEMIC STUDY ON SEA-AIR TRANSPORT. YOUR ASSISTANCE IS VERY HIGHLY APPRECIATED.

NAME & ADDRESS OF AIRPORT:-

1. COUNTRY :____________________ CITY :____________________

2. MANAGEMENT :

   a) GOVERNMENT DEPARTMENT AUTHORITIES |__| YES |__| NO

   b) PRIVATE |__| YES |__| NO

   c) OTHERS |__| YES |__| NO

3. HOURS OF OPERATION

   |__| 24 HRS |__| 18 HRS |__| LESS THAN 18 HRS

4. ANY OPERATIONAL RESTRICTION?

   |__| YES |__| NO

   IF YES PLS. SPECIFY: ______________________________

5. IS THE CARGO DEPT. UNDER THE MANAGEMENT OF THE AIRPORT?

   |__| YES |__| NO

6. DO YOU HAVE A SEA-AIR CARGO DEPT.?

   |__| YES |__| NO

   IF YES, PLS. SUPPLY THE FOLLOWING DETAILS

   NUMBER OF STAFF :____________________

   WHEN ESTABLISHED :____________________

   NUMBER OF SALES REPS SELLING SEA-AIR METHOD:________________

7. HOW DO THEY MARKET SEA-AIR CARGO TRANSPORTATION?

   |__| BY ATTRACTING NEW SERVICES

   |__| BY PROVIDING SPECIAL RATES & CHARGES

   |__| BY GIVING INCENTIVES TO FREIGHT FORWARDERS

8. WHO DOES THE HANDLING?

|__| AIRPORT AUTHORITY

|__| AIRLINE

|__| PRIVATE COMPANIES

|__| OTHERS

9. DO YOU HAVE SEA-AIR STATISTICS ?

|__| YES |__| NO

IF YES THEN BY: |__| DESTINATION |__| COMMODITY |__| VOLUME

10. WHO CONTROLS THE AIRPORT WAREHOUSE?

|__| AIRPORT MANAGEMENT

|__| HANDLING AGENT

|__| AIRLINE

|__| FORWARDERS

11. DO YOU SUPERVISE LOADING/UNLOADING OF SEA-AIR CARGO?

|__| YES |__| NO

12. WHO PROVIDES CARGO HANDLING

|__| HANDLING AGENT

|__| SEA-AIR FORWARDERS/OPERATORS

|__| AIRLINE

|__| OTHERS

13. DOES THE FORWARDER HAVE ACCESS TO THE WAREHOUSE AT AIRPORTS?

|__| YES |__| NO

14. WHO CERTIFIES NO OF PIECES PER SHIPMENT

a) HANDLING AGENT |__| YES |__| NO

b) FORWARDER |__| YES |__| NO

c) AIRPORT AUTHORITY |__| YES |__| NO

d) OTHERS |__| YES |__| NO

15. WHO DOES THE UNLOADING OF THE CARGO FROM THE SHIPPING LINE CONTAINERS TO THE WAREHOUSE?

a) AIRPORT STAFF |__| YES |__| NO

b) HANDLING AGENT |__| YES |__| NO

c) FORWARDERS |__| YES |__| NO

d) OTHERS |__| YES |__| NO

16. DURING PREVIOUS YEARS HAVE YOU EXPERIENCED ANY

a) DAMAGED CARGO, THEFT, ETC.

|__| YES |__| NO

b) IF YES, THEN WHAT PERCENTAGE?

'88 ________ % '89 ________ % '90 ________ % '91 ________ %

17. WHO DOES THE PALLETIZATION?

a) HANDLING AGENTS |__| YES |__| NO

b) SEA-AIR FWDR/OPR |__| YES |__| NO

c) AIRPORT AUTHORITY |__| YES |__| NO

d) OTHERS |__| YES |__| NO

18. HOW LONG DOES IT TAKE TO TRANSPORT THE CONTAINER FROM SEA PORT TO MAIN AIRPORT?

|__| 1 TO 4 HOURS

|__| 4 TO 6 HOURS

|__| 6 TO 12 HOURS

|__| IF MORE THAN 12 HOURS, PLS. SPECIFY

19. HOW FAR IS THE SEA PORT - WHICH HANDLES THE SEA-AIR CARGO - FROM THE AIRPORT?

|__| LESS THAN 10 MILES

|__| BETWEEN 10 & 20 MILES

|__| BETWEEN 20 & 40 MILES

|__| BETWEEN 40 & 60 MILES

|__| MORE THAN 60 MILES

20. FOR HOW LONG DOES THE SEA-AIR CARGO REMAIN IN TRANSIT?

|__| LESS THAN 6 HRS

|__| BETWEEN 6 AND 12 HRS

|__| MORE THAN 12 HRS

|__| OTHERS, PLS. SPECIFY ____________________

21. HANDLING OF SEA-AIR SHIPMENT (ARRIVAL OF CARGO)

a) DOES THE CARGO ARRIVE STRICTLY IN CONTAINERS

|__| YES |__| NO

b) WHAT PERCENTAGE OF IT IS IN 20' CONTAINER: ________ %

c) WHAT PERCENTAGE IN 40' CONTAINER: ________ %

d) WHAT PERCENTAGE IN OTHERS (PLEASE SPECIFY) : ________ %

22. IF CARGO ARRIVES STRICTLY IN CONTAINERS, THEN WHAT PERCENTAGE

a) FCL ________ % b) LCL ________ % c) OTHERS ________ %

23. SEA-AIR VOLUME IN TONNES

a) 1988 ________ b) 1989 ________

c) 1990 ________ d) 1991 ________

24. NATURE OF COMMODITIES, PERCENTAGE OF TOTAL VOLUME:

a) GARMENTS : ________ %

b) TEXTILES : ________ %

c) COMPUTERS (RELATED PARTS) : ________ %

d) FOOTWEAR : ________ %

e) ELECTRONIC PRODUCTS : ________ %

f) OTHERS (MISC.) SUCH AS COSMETICS, NOVELTIES, TOYS ETC. :

________ %

25. WHAT IS THE FREIGHT CAPACITY AVAILABLE AT YOUR MAIN AIRPORT?

____

26. IF THERE WAS ANY INCREASE, OVER THE LAST 4 YR., WAS IT BECAUSE OF SEA-AIR?

|__| YES |__| NO

27. IF YES WHAT PERCENTAGE OF IT WAS THROUGH REGULAR FLIGHTS AND WHAT PERCENTAGE WAS CHARTER FLIGHTS?

1988	|__| % REGULAR	|__| % CHARTER
1989	|__| % REGULAR	|__| % CHARTER
1990	|__| % REGULAR	|__| % CHARTER
1991	|__| % REGULAR	|__| % CHARTER

28. WHAT % WITH CARGO FLIGHTS AND WHAT % WAS PAX FLIGHTS

1988	|__| % CARGO	|__| % PAX
1989	|__| % CARGO	|__| % PAX
1990	|__| % CARGO	|__| % PAX
1991	|__| % CARGO	|__| % PAX

29. DO YOU EXPERIENCE BACKLOGS?

|__| YES |__| NO

30. IF YES, IS IT BECAUSE OF

a)	LIMITED CAPACITY?	|__| YES	|__| NO
b)	INCREASE OF SEA-AIR VOLUME	|__| YES	|__| NO
c)	LOW RATE	|__| YES	|__| NO

31. WHICH PERIOD OF THE YEAR SHOWED THE HIGHEST SEA-AIR ACTIVITY?

|__| 1ST QUARTER |__| 2ND QUARTER

|__| 3RD QUARTER |__| 4TH QUARTER

32. DO YOU DIVERT BACKLOGS TO OTHER AIRPORTS?

|__| YES |__| NO

33. IF YES HOW FAR IS THE OTHER AIRPORT

|__| 0 - 50 MILES |__| 50 - 100 MILES

|__| MORE THAN 100 MILES

34. WHAT PERCENTAGE HAS BEEN DIVERTED LAST YEAR TO OTHER AIRPORTS

BY TRUCK ________ %   BY TRAIN ________ %

35. DO YOU HAVE AN 'OPEN SKY POLICY'?

|__| YES |__| NO

36. ARE AIRPORT AUTHORITIES FULLY AWARE OF THE TIME ELEMENT REQD. FOR SEA-AIR CARGO MOVEMENT

|__| YES |__| NO

37. WHAT MEASURES WERE ADOPTED TO IMPROVE MOVEMENT

|__| LONGER WORKING HRS |__| ADDITIONAL SHIFTS

|__| OTHERS - PLS. SPECIFY

____

38. IN CASE OF ADDITIONAL WORKING HRS

US$ ______ MORE PER TONNE |__| NO CHARGE

|__| OTHERS - PLS. SPECIFY

39. ONCE SEA-AIR CARGO REACHES THE MAIN AIRPORT CARGO TERMINAL:

a) AVERAGE TIME IN WAREHOUSE ________

b) WAREHOUSE FREE TIME ALLOWED BY AIRPORT AUTHORITY

|__| 6 - 12 HRS |__| 12 - 24 HRS

|__| 24 - 48 HRS |__| MORE THAN 72 HRS (PLS. SPECIFY)

40. WHAT DEMURRAGE CHARGE AFTER FREE TIME ALLOWANCE

|__| PER TONNE |__| PER CBM

|__| PER TEU |__| OTHERS (PLS. SPECIFY)

41. WHAT ARE THE AVG. DEMURRAGE CHARGES LEVIED BY AIRPORT AUTHORITIES

PER DAY US$ ________   PER MONTH US$ ________

PER YEAR ________

42. WHAT PERIOD OF THE YEAR SHOWED THE HIGHEST YIELD FROM DEMURRAGE:

|__| 1ST QUARTER |__| 2ND QUARTER

|__| 3RD QUARTER |__| 4TH QUARTER

43. WHO CUSTOM CLEARS SEA-AIR CARGO?

|__| LICENSED CUSTOM HOUSE BROKER |__| LICENSED FRGT FORWARDER

|__| SHIPPING LINE |__| AIRLINE

|__| OTHERS PLS. SPECIFY ______________________________

44. WHAT DOCUMENTS ARE NEEDED TO CUSTOM CLEAR SEA-AIR CARGO PORT TO AIRPORT

|__| PACKING LIST + INVOICE + B/L ORIGINAL

|__| INVOICE + B/L ORIGINAL

|__| PACKING LIST + B/L ORIGINAL

|__| COMBINED TRANSPORT DOCUMENTS

|__| OTHERS PLS. SPECIFY ______________________________

45. HOW DOES SEA-AIR CARGO MOVE IN TRANSIT FROM PORT TO AIRPORT WITHOUT PAYING ENTRY DUTIES BY:

|__| BANK GUARANTEE TO CUSTOMS AUTHORITY

|__| FORWARDERS GUARANTEE TO CUSTOMS AUTHORITY

|__| CUSTOMS HOUSE BROKER GUARANTEE

|__| OTHER MEANS, PLS. SPECIFY ______________________________

46. DURING WHAT HOURS OF THE DAY SHOULD TRANSIT CUSTOMS CLEARANCE BE DONE

|__| BETWEEN 8.00 AM - 5.00 PM

|__| BETWEEN 8.00 AM - 12 MIDNIGHT

|__| AFTER 5.00 PM AT AN EXTRA COST OF US$ ________ PER HOUR

|__| OTHERS, PLS. SPECIFY ______________________________

47. PLS. ATTACH A LIST OF SCHD. PAX FLIGHTS FROM YOUR AIRPORT TO:

CITIES IN CENTRAL & NORTHERN EUROPE	TYPE OF A/C	FLTS/DAY	FLTS/WEEK

48. PLS. ATTACH A LIST OF SCHD CARGO FLIGHTS FROM YOUR AIRPORT TO:

CITIES IN CENTRAL & NORTHERN EUROPE	TYPE OF A/C	FLTS/DAY	FLTS/WEEK

49. FROM AVLBL STATISTICS (PUBLISHED OR ON RECORD) PLS. NAME 10 CLASSES OF COMMODITIES EXPORTED FROM YOUR AIRPORT, WITH TONNAGE

COMMODITY CLASS	T'NAGE 88	T'NAGE 89	T'NAGE 90	T'NAGE 91
1.				
2.				
3.				
4.				
5.				
6.				
7.				
8.				
TOTALS				

50. PLEASE NAME MAIN COMMODITIES THAT ARE PRODUCED IN YOUR AREA AND EXPORTED BY AIR, AND IF POSSIBLE:

COMMODITY CLASS	T'NAGE 88	T'NAGE 89	T'NAGE 90	T'NAGE 91
1.				
2.				
3.				
4.				
5.				
6.				
7.				
8.				
TOTALS				

51. DO YOU AIR EXPORT COMMODITIES FROM OTHER AREAS IN YOUR COUNTRY THROUGH YOUR AIRPORT FACILITY?

|__| YES |__| NO

52. IF YES WHAT IS THE TONNAGE

1988 TONNAGE ____________ 1989 TONNAGE ________________

1990 TONNAGE ____________ 1991 TONNAGE ________________

53. WHAT ARE THE MAIN CLASSES OF THIS COMMODITY?

1.
2.
3.
4.
5.

54. WHERE FROM DO THEY ARRIVE AT YOUR AIRPORT?

1.
2.
3.
4.
5.

55. MEANS OF TRANSPORT FROM OTHER AREAS OF YOUR COUNTRY TO YOUR AIRPORT?

	T'NAGE 88	T'NAGE 89	T'NAGE 90	T'NAGE 91
1. BY AIR				
2. OVERLAND				
3. RAIL				
4. OTHER MEANS (PLS. SPECIFY)				

56. OF THE COMMODITIES ARRIVING BY OCEAN AND THEN RE-EXPORTED BY AIR FROM YOUR MAIN AIRPORT

WHAT T'NAGE FROM	T'NAGE 88	T'NAGE 89	T'NAGE 90	T'NAGE 91
1. JAPAN				
2. S.KOREA				
3. TAIWAN				
4. HONGKONG				
5. SINGAPORE				
6. OTHERS				

57. NATURE OF THESE COMMODITIES AND RELEVANT TONNAGE EX FAR EAST

COMMODITY CLASS	T'NAGE 88	T'NAGE 89	T'NAGE 90	T'NAGE 91
1.				
2.				
3.				
4.				
5.				
6.				
7.				
8.				
9.				
10.				

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Reports on questionnaires

SEA-AIR REPORT BASED ON INFORMATION RECEIVED FROM FREIGHT FORWARDERS OF TAIPEI, TAIWAN

The following information has been condensed from interviews and questionnaires from 12 to 16 Freight Forwarders in Taipei. Their contacts were established through introductions from the Freight Forwarding Industry in the Sea-Air hubs of Seattle, Los Angeles, and the United Arab Emirates:

Freight Forwarders in Taipei offer Shippers/Exporters, either type of Sea-Air service, 'All inclusive cost door to door', or 'Cost per service'. They also offer a variety of Sea-Air transfer points like Seattle, Singapore, and the U.A.E. A few via Los Angeles, but not through Vladivostok.

The Sea-Air rates/transit times, as per the forwarders is as per the following details:

to Western Europe via Seattle, the rate is from US$ 1.60 to 2.00, with a transit time (to the final destination) of between 16 - 22 days.

to Western Europe via the U.A.E, the rate is from US$ 1.60 to 2.00, with a transit time (to the final destination) of between 15 - 19 days.

to Western Europe via Singapore, the rate is from US$ 2.20 to 2.80, with a transit time (to the final destination) of between 6 - 11 days.

Sea-Air destined for South America is sent via Los Angeles, with the rate ranging between US$ 1.60 to US$ 2.80. The transit time here is between 14 - 23 days.

As far as direct containerised shipping goes, the Freight Forwarders provided rates/transit times through the U.A.E. Sea-Air hub, which was as follows:

to Western Europe for a 20' container the rates ranged from US$ 1300 - 1500, & for a 40' container, from US$ 2600 - 3000. The transit time being 25 - 32 days.

to the Scandinavian Countries, for a 20' container the rates ranged from US$ 1400 - 1900, & for a 40' container, from US$ 2700 - 2800. The transit time being between 30 - 35 days.

to Portugal & Spain, for a 20' container the rates ranged from US$ 1325 - 1900, & for a 40' container, from US$ 2650 - 2800. The transit time being between 25 - 35 days.

Documentation charges was stated as US$ 10.00.

For All Air rates, the Freight forwarders provided the following information:

to Western Europe the high rate was from US$ 3.00 - 3.80 per kg, & the low rate ranged from US$ 2.80 - 3.50 per kg.

to the Scandinavian Countries, the high rate was from US$ 3.20 - 4.8 per kg, & the low rate ranged from US$ 2.80 - 4.30 per kg.

to Portugal & Spain, the high rate was from US$ 3.00 - 5.0 per kg, & the low rate ranged from US$ 2.90 - 4.20 per kg.

All the Freight Forwarders in Taiwan operated with the use of Sea-Air schedules. The majority agreed that in the order of importance, what the supplier was looking for was:

1. Short transit time & lower transportation cost.
2. Lower transportation cost.
3. Short Transit time.
4. Flexibility
5. Lower insurance cost.

The bulk of the type of commodities that were transported was mainly computer related parts, which made up 60% to 70% of the total volume. The rest was made up of Garments, textiles, & General Commodities (of values ranging between US$ 4/kg - US$ 20/kg), of about 10% each of the total volume, with the percentage varying in small amounts from forwarder to forwarder.

The Freight Forwarders all agreed that for the Shipper/Supplier, delivery time and the total cost of Sea-Air shipping, to the final destination, were very important factors. Most were of the opinion that if there were no Sea-Air service, the bulk of the cargo would travel by both Air & Sea.

For the orders of Sea-Air, they ranked the following in their order of importance as below:

1. Specific instruction from consignee.
2. Urgency of order need at destination.
3. Seasonality of commodity exported.
4. Letter of credit time limit.
5. Competition at consignee's market.
6. Demand in country of destination.
7. Introduction of a new commodity.
8. To save on storage charges at consignee market..

Most of the Freight Forwarders experienced backlogs at the Airport of origin, to Europe, mainly because of limited cargo capacity, and to an extent limited Airport capacity.

The 1st Quarter & the 4th Quarter of the year (esp. the 4th), was considered the period when space to Europe is very tight. Most Freight Forwarders would prefer a flat rate for Sea-Air cargo.

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SEA-AIR REPORT BASED ON INFORMATION RECEIVED FROM FREIGHT FORWARDERS OF SINGAPORE

The following information has been condensed from interviews and questionnaires from 12 to 16 Freight Forwarders in Singapore. Their contacts were established through introductions from the Freight Forwarding Industry in the Sea-Air hubs of Seattle, Los Angeles, and the United Arab Emirates:

Some Freight Forwarders in Singapore offer Shippers/Exporters, 'All inclusive cost door to door' type of Sea-Air service, and some 'Cost per service'. They also offer a variety of Sea-Air transfer points like Seattle, Singapore, and the U.A.E. A few via Los Angeles, but not through Vladivostok.

The Sea-Air rates/transit times, as per the forwarders is as per the following details:

to Western Europe via Seattle, the rate is US$ 1.95, with a transit time (to the final destination) of between 16 - 19 days.

to Western Europe via the U.A.E, the rate is from US$ 1.50 to 1.85, with a transit time (to the final destination) of between 12 and a half - 19 days.

to Western Europe via Singapore, the rate is from US$ 2.00 to 2.90, with a transit time (to the final destination) of between 7 - 12 days.

There was no data for Sea-Air sent via Los Angeles.

As far as direct containerised shipping goes, the Freight Forwarders provided rates/transit times through the U.A.E. Sea-Air hub, which was as follows:

to Western Europe for a 20' container the rates ranged from US$ 1300 - 1500, & for a 40' container, from US$ 2600 - 3000. The transit time being 25 - 32 days.

to the Scandinavian Countries, for a 20' container the rates ranged from US$ 1400 - 1900, & for a 40' container, from US$ 2700 - 2800. The transit time being between 30 - 35 days.

to Portugal & Spain, for a 20' container the rates ranged from US$ 1325 - 1900, & for a 40' container, from US$ 2650 - 2800. The transit time being between 25 - 35 days.

For All Air rates, the Freight forwarders provided the following information:

to Western Europe the high rate was from US$ 3.00 - 3.80 per kg, & the low rate ranged from US$ 2.80 - 3.50 per kg.

to the Scandinavian Countries, the high rate was from US$ 3.20 - 4.8 per kg, & the low rate ranged from US$ 2.80 - 4.30 per kg.

to Portugal & Spain, the high rate was from US$ 3.00 - 5.0 per kg, & the low rate ranged from US$ 2.90 - 4.20 per kg.

All the Freight Forwarders in Singapore operated with the use of Sea-Air schedules. The majority agreed that in the order of importance, what the supplier was looking for was:

1. Short transit time & lower transportation cost.
2. Lower transportation cost.
3. Flexibility
4. Short Transit time.
5. Lower insurance cost.

The Freight Forwarders all agreed that for the Shipper/Supplier, delivery time was an important factor and the total cost of Sea-Air shipping, to the final destination, was a very important factor. Most were of the opinion that if there were no Sea-Air service, the bulk of the cargo would travel by both Air & Sea.

For the orders of Sea-Air, they ranked the following in their order of importance as below:

1. Urgency of order need at destination.
2. Specific instruction from consignee.
3. Seasonality of commodity exported.
4. Letter of credit time limit.
5. Demand in country of destination.
6. Competition at consignee's market.
7. To save on storage charges at consignee market.
8. Introduction of a new commodity.

Some of the Freight Forwarders did not experience backlogs at the Airport of origin, to Europe, while some did, mainly because of limited cargo capacity.

The 3rd Quarter & the 4th Quarter of the year were considered the period when space to Europe is very tight. Some Freight Forwarders would prefer a flat rate for Sea-Air cargo, and some a fixed rate.

In order to improve the Sea-Air service, the Freight Forwarders recommended faster ships, to improve on the transit time. Air rates also required to be lowered. They also complained that they lost out in the exchange rate as they paid in Singapore dollars.

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SEA-AIR REPORT BASED ON INFORMATION RECEIVED FROM FREIGHT FORWARDERS OF SEOUL, SOUTH KOREA

The following information has been condensed from interviews and questionnaires from 12 to 16 Freight Forwarders in Seoul. Their contacts were established through introductions from the Freight Forwarding Industry in the Sea-Air hubs of Seattle, Los Angeles, and the United Arab Emirates:

Freight Forwarders in Seoul offer Shippers/Exporters, either type of Sea-Air service, 'All inclusive cost door to door', or 'Cost per service'. They also offer a variety of Sea-Air transfer points like Seattle, Singapore, Los Angeles and the U.A.E.

The Sea-Air rates/transit times, as per the forwarders is as per the following details:

to Western Europe via Seattle, the rate is from US$ 1.60 to 1.70, with a transit time (to the final destination) of between 17 - 19 days.

to South America via Seattle, the rate is US$ 2.30, with a transit time (to the final destination) of 20 days.

to Western Europe via the U.A.E, the rate is from US$ 1.80 to 1.90, with a transit time (to the final destination) of between 21 - 24 days.

to Western Europe via Singapore, the rate is from US$ 2.20 to 3.00, with a transit time (to the final destination) of 8 - 12 days.

Sea-Air destined for South America is sent via Los Angeles, with the rate ranging between US$ 2.80 to US$ 3.20. The transit time here is between 18 - 21 days.

As far as direct containerised shipping goes, the Freight Forwarders provided rates/transit times through the U.A.E. Sea-Air hub, which was as follows:

to Western Europe for a 20' container the rates ranged from US$ 1200 - 1500, & for a 40' container, US$ 2400. The transit time being 26 - 28 days.

to the Scandinavian Countries, for a 20' container the rate given was US$ 1500, & for a 40' container, US$ 3000. The transit time being between 30 - 32 days.

Document charges were US$ 5.00 on an average.

For <u>All Air rates</u>, the Freight forwarders provided the following information:

to Western Europe the high rate was from US$ 2.50 - 3.00 per kg, & the low rate ranged from US$ 1.90 - 2.70 per kg.

to the Scandinavian Countries, the high rate was from US$ 2.55 -3.00 per kg, & the low rate ranged from US$ 2.00 - 2.70 per kg.

to Portugal & Spain, the high rate was from US$ 2.55 - 3.20 per kg, & the low rate ranged from US$ 2.00 - 2.90 per kg.

The Freight Forwarders in Korea operated with the use of Sea-Air schedules. The majority agreed that in the order of importance, what the supplier was looking for was:

1. Short transit time & lower transportation cost.
2. Lower transportation cost.
3. Short Transit time.
4. Flexibility
5. Lower insurance cost.

The bulk of the type of commodities that were transported was mainly electronics/computer related parts & Garments/textiles. Also a large part of the volume were General Commodities (of values ranging between US$ 4/kg - US$ 20/kg), varying in small amounts from forwarder to forwarder.

The Freight Forwarders all agreed that for the Shipper/Supplier, delivery time and the total cost of Sea-Air shipping, to the final destination, were very important factors. They were divided in their opinion that if there were no Sea-Air service, the bulk of the cargo would travel by both Air & Sea or all air.

For the orders of Sea-Air, they ranked the following in their order of importance as below:

1. Urgency of order need at destination.
2. Specific instruction from consignee.
3. Demand in country of destination.
4. Seasonality of commodity exported.
5. Letter of credit time limit.
6. To save on storage charges at consignee market.
7. Introduction of a new commodity.
8. Competition at consignee's market.

Some of the Freight Forwarders experienced backlogs at the Airport of origin, to Europe, mainly because of limited cargo flights.

The 4th Quarter of the year was considered the period when space to Europe is very tight. Freight Forwarders would prefer a flat rate for Sea-Air cargo.

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SEA-AIR REPORT BASED ON INFORMATION RECEIVED FROM FREIGHT FORWARDERS OF TOKYO, JAPAN

The following information has been condensed from interviews and questionnaires from 12 to 16 Freight Forwarders in Tokyo. Their contacts were established through introductions from the Freight Forwarding Industry in the Sea-Air hubs of Seattle, Los Angeles, and the United Arab Emirates:

Freight Forwarders in Tokyo offer Shippers/Exporters, either type of Sea-Air service, 'All inclusive cost door to door', or 'Cost per service'. They also offer a variety of Sea-Air transfer points like Seattle, Los Angeles, Vladivostok. One Freight Forwarder also offered the Sea-Air hubs of Singapore and the U.A.E.

The Sea-Air rates/transit times, as per the forwarders is as per the following details:

to Western Europe via Seattle, the rate is from US$ 1.45 to 2.50, with a transit time (to the final destination) of between 13 - 17 days.

to Western Europe via the U.A.E, the Freight forwarders did not provide any data of either rates or transit time.

to Western Europe via Singapore, the rate is US$ 2.35, with a transit time (to the final destination) of 12 days.

Sea-Air destined for South America is sent via Los Angeles, with the rate being US$ 3.00 to Brazil, and US$ 3.50 to Argentina. The transit time here is between 16 - 18 days.

The rate for Sea-Air via Vladivostok to Europe ranges from US$ 2.50 to 3.00, with a transit time of between 07 - 10 days.

As far as direct containerised shipping goes, the Freight Forwarders provided rates/transit times through the Seattle Sea-Air hub, which was as follows:

to Western Europe for a 20' container the rate was US$ 1800, & Conference rate was US$ 2500. And for a 40' container Conference rate was US$ 4000. The transit time being 32 days.

to Seattle for a 20' container the rate was US$ 1300, & Refrigerator rate was US$ 950. And for a 40' container, normal rate was US$ 1900 & Refrigerator rate was US$ 1300. The transit time being 9 days.

to the Scandinavian Countries, for a 20' container the rate given was US$ 2700. Conference rate was US$ 4000, & Non Conference rate US$ 1600 - 1700. And for a 40' container, Conference rate was US$ 8000, and non conference as US$ 3200. The transit time being 32 days.

to Portugal/Spain, for a 20' container the rate given by one Freight Forwarder was US$ 2500, with a transit time of 32 days.

For All Air rates, the Freight forwarders provided the following information:

to Western Europe the high rate was from US$ 5.65 - 7.8 per kg, & the low rate ranged from US$ 2.60 - 3.50 per kg.

to the Scandinavian Countries, the high rate was from US$ 7.00 -9.55 per kg, & the low rate ranged from US$ 4.35 - 5.20 per kg.

to Portugal & Spain, the high rate was from US$ 6.55 - 8.7 per kg, & the low rate ranged from US$ 4.10 - 6.95 per kg.

The Freight Forwarders in Tokyo operated with the use of Sea-Air schedules. The majority agreed that in the order of attractiveness, what the supplier was looking for was:

1. Short transit time & lower transportation cost.
2. Lower transportation cost.
3. Short Transit time.
4. Flexibility
5. Lower insurance cost.

The bulk of the type of commodities that were transported was electronic products & computer related parts. Also a large part of the volume were General Commodities of value over US$ 20/kg.

The Freight Forwarders all agreed that for the Shipper/Supplier, delivery time and the total cost of Sea-Air shipping, to the final destination, were very important factors. They were also of the opinion that if there were no Sea-Air service, the bulk of the cargo would travel by both Air & Sea.

For the orders of Sea-Air, they ranked the following in their order of importance as below:

1. Specific instruction from consignee.
2. Urgency of order need at destination.
3. Seasonality of commodity exported.
4. Competition at consignee's market.
5. Introduction of a new commodity.
6. Demand in country of destination.
7. Letter of credit time limit.
8. To save on storage charges at consignee market.

None of the Freight Forwarders experienced backlogs at the Airport of origin, to Europe.

The 1st Quarter & the 4th Quarter of the year (esp. the 4th), was considered the period when space to Europe is very tight. All Freight Forwarders would prefer a flat rate for Sea-Air cargo.

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SEA-AIR REPORT BASED ON INFORMATION RECEIVED FROM FREIGHT FORWARDERS OF HONGKONG

The following information has been condensed from interviews and questionnaires from 12 to 16 Freight Forwarders in HongKong. Their contacts were established through introductions from the Freight Forwarding Industry in the Sea-Air hubs of Seattle, Los Angeles, and the U.A.E.

Some Freight Forwarders in HongKong offer Shippers/Exporters, 'All inclusive cost door to door', type of Sea-Air service, and some 'Cost per service'. They also offer a variety of Sea-Air transfer points like Seattle, Singapore, Los Angeles and the U.A.E, but not through Vladivostok.

The Sea-Air rates/transit times, as per the forwarders is as per the following details:

to Western Europe via Seattle, the rate is from US$ 1.35 to 1.90, with a transit time (to the final destination) of between 18 - 22 days.

to Western Europe via the U.A.E, the rate is from US$ 1.50 to 2.00, with a transit time (to the final destination) of between 15 - 16 days.

to Western Europe via Singapore, the rate is US$ 3.00, but we had no data for the transit time.

Sea-Air destined for South America is sent via Los Angeles. One Freight forwarder also used LA as a hub for goods to Europe, with the rate being US$ 1.70, the transit time here is between 15 - 17 days. Sea-Air to South America via Los Angeles is at the rate of US$ 1.80, with a transit time of 12 days.

As far as direct containerised shipping goes, the Freight Forwarders provided rates/transit times through the U.A.E. Sea-Air hub, which was as follows:

to Western Europe for a 20' container the rates ranged from US$ 1150 - 1500, and for a 40' container, from US$ 2300 - 3000. The transit time being 19 - 30 days.

to the Scandinavian Countries, for a 20' container the rates ranged from US$ 1300 - 1650. & for a 40' container. from US$ 2900 - 3300. The transit time to Portugal for a 20' container the rates ranged from US$ 1950 -2100, the transit time being 33 - 40 days. For a 20' container to Spain, from US$ 1200 - 1500. The transit time being between 21 - 30 days.

Documentation charges are standard at HK $ 50 (i.e. US$ 6.60)

For All Air rates, the Freight Forwarder's provided the following information:

to Western Europe the high rate was from US$ 3.20 - 3.95 per kg, & the low rate ranged from US$ 2.50 - 3.15 per kg.

to the Scandinavian Countries, the high rate was from US$ 3.35 -4.20 per kg, & the low rate ranged from US$ 2.60 - 3.40 per kg.

to Portugal & Spain, the high rate was from US$ 3.35 - 4.20 per kg, & the low rate ranged from US$ 2.60 - 3.40 per kg.

All the Freight Forwarders in HongKong operated with the use of Sea-Air schedules. The majority agreed that in the order of attractiveness, what the supplier was looking for was:

1. Short transit time & lower transportation cost.

2. Lower transportation cost.

3. Short Transit time.

4. Flexibility

5. Lower insurance cost.

The nature of the commodities that were transported varied from Forwarder to Forwarder, but for the main it included Garments/Textiles - between 60 & 75% - & General Commodities (of values ranging between US$ 4.00/kg - US$ 20.00/kg).

The Freight Forwarders all agreed that for the Shipper/Supplier, delivery time and the total cost of Sea-Air shipping, to the final destination, were very important factors. There was a mixed opinion of how cargo would move if there were no Sea-Air service. The majority said that the bulk of the cargo would travel by Air, while some thought that it would go by both air and sea.

For the orders of Sea-Air, they ranked the following in their order of importance as below:

1. Urgency of order need at destination.
2. Specific instruction from consignee.
3. Demand in country of destination.
4. Letter of credit time limit.
5. Seasonality of commodity exported.
6. To save on storage charges at consignee market.
7. Competition at consignee's market.
8. Introduction of a new commodity.

The Freight Forwarders were divided in their opinion on whether they experienced backlogs at the Airport of origin.

The 4th Quarter of the year was considered the period when space to Europe is very tight. Some said that the 2nd & 3rd were tight too. Most Freight Forwarders would prefer a flat rate for Sea-Air cargo.

Some points that were made by the Freight Forwarders, that had a bearing on Sea-Air from Far East to Europe are:

All air rates dropped by nearly 20% in 1991/1992, and shippers preferred that to Sea-Air. One FREIGHT FORWARDER stated that in 1992 Air rate reduced by $ 2.00.

Shipping Lines began providing faster service.

Portugal & Spain are better connected throughout the American West Coast, rather than U.A.E., because with the U.A.E. hub, Sea-Air has to transit one more European point on the way to Portugal/Spain.

The Freight Forwarders of the Far East recommend the rates via different transit points. The decision on which route to choose rests with the client.

A way to improve Sea-Air would be to increase flights out of the hub, and a lower cost from the hub, shorten the transit time.