Different rates of bilateral and market liberalisation and the development of ultra long-haul types are compounding to fuel demand for aircraft smaller than the 747. This will bolster the market for the A330/340, 777 and Boeing's new Super Efficient aircraft.

The evolution of long-haul markets

As bilateral air agreements are liberalised, more routes become available for carriers to operate. The trans-Atlantic has already witnessed the changes that open-skies have on air service levels. Will routes to the Asia Pacific from both the US and Europe follow a similar pattern?

Bilateral developments have always influenced the evolution of markets, with countries seeking to protect or limit their home market from competitors. Even with the majority of carriers no longer state owned, bilateral restrictions still limit route development, forcing carriers to carry passengers to gateways rather than service unique city pairs. This also limits traffic growth and development.

The signing of open skies agreements between European countries and the US and easing of restrictions on the trans-Atlantic has seen traffic fragment, with more city-pairs being served. This has seen a reduction in average aircraft size, with smaller capacity aircraft being utilised on all but the densest routes.

Will the easing of bilateral restrictions on trans-Pacific and Europe-Asia routes prompt a similar splintering of traffic, or will carriers be forced to continue to channel traffic through existing routes? The development of bilaterals will influence the optimal aircraft types deployed within these markets, and thus demand for them.

Political environment

The US government has developed open skies agreements with many European countries. The first agreement was with the Netherlands in 1992. Most European countries have since signed an open skies agreement with the US.

The result of this liberalisation has been the fragmentation of route networks from trunk routes towards more point-to-point services.

In 1983 TWA operated a daily 747 Chicago-London service, and was the only operator. There are now 15 routes from Chicago to Europe, and few with a 747. This is partly attributable to the liberalisation of bilateral restrictions.

Airlines face greater battles to gain market liberalisation. Airlines have responded to these constraints by forming alliances in an attempt to maximise traffic flow and extend their global reach.

Alliances vary from simple codesharing, to deeper alliances that involve anti-trust immunity. Anti-trust immunity allows airlines to align pricing and sales strategies, and coordinate schedules. Even these alliances are not fully effective, since American Airlines and Cathay Pacific have only just received authority to codeshare on flights, a fundamental requirement of an alliance, despite being in the one World Alliance for three years. The existing bilateral between Hong Kong and the US did not allow for codesharing, requiring the agreement to be re-written.

Regulatory restrictions limit the benefit of an alliance to an airline. British Airways/America Airlines have tried to get anti-trust immunity on the North Atlantic, but government demands to relinquish Heathrow slots proved prohibitive.

Airlines recognise the benefits that liberalisation brings, and the additional traffic that can be sourced. Singapore, New Zealand, and Australia signed an open skies accord in the mid 1990s, allowing the respective carriers from each country access to the others' markets. Qantas operates domestic New Zealand flights, while Air New Zealand operates Sydney-Los Angeles services. Singapore has not yet exercised its options.

The Netherlands signed the first trans-Atlantic open skies treaty, and has been very supportive of market liberalisation, because KLM has a limited domestic passenger volume, and must secure sixth-freedom traffic. "We have always supported liberalisation, because we rely on connecting traffic. The best method to source this is to have open competition,"says Bart Koster, spokesperson at KLM. "The EU has taken over some of the negotiations on behalf of member nations and we welcome that, since it is a more powerful entity."

The current regulatory framework makes bilateral negotiation a slow process. Even open skies has no guarantee for continued success, with the European Court of Justice declaring void various portions of bilateral open skies agreements between the US and seven European nations. The EU has ruled that parts of the agreements are not competition friendly. The EU has assumed responsibility for negotiating future agreements.

Bilaterals are generally designed to protect a nation's home market from exploitation. India, for example, imposes deeply restrictive bilateral rules on foreign carriers, often limiting both frequency and capacity.

Trans-Atlantic

Most European countries have an open skies agreement with the US. This has seen more city-pairs being served.

This has influenced the aircraft size used, with most routes operated by 767/A330. Larger aircraft like the 777-200/-300 and A340-200/-300 are deployed on higher demand routes like Washington, Pittsburgh and Denver. The 747 is only used on the heaviest routes from Europe's major cities of London, Paris and Frankfurt to cities such as Los Angeles, New York, and Chicago.

The 747 was the standard aircraft used on the trans-Atlantic, because airlines were restricted to servicing gateways. They flew large aircraft between hubs, and relied on partner airlines to complete the passengers' travel

requirements. Tim Meskill, Boeing's manager of market analysis explains: "As new flights are added to a network to service a new city-pair, it splits off those passengers from connecting services. This reduces the pressure on the incumbent routes and removes the problem of excessive spill."

The increase in city-pairs removed the connection traffic that carriers could pass over their hubs, making the 747 too large and uneconomic for the market. As route numbers proliferate and more city-pairs are developed, the amount of connecting traffic on incumbent routes is reduced.

CAPACITY DATA FOR BUSIEST ROUTES IN MAJOR LONG-HAUL MARKETS

Market	Daily frequency	Average seats per day	Average seats per departure
Trans-Atlantic	10	2,984	303
Trans-Pacific	6	1,996	370
Europe-Asia Pacific	5	1,700	362

Asia Pacific-Europe

Bilateral restrictions between Europe and the Asia Pacific limit the frequencies airlines operate on each route, resulting in lower route development than the trans-Atlantic. Carriers still operate from hub to hub, relying on large aircraft like the 747 and the A380. Routes to the Asia Pacific have the largest aircraft size *(see chart, this page)*.

With restricted frequencies, carriers are unlikely to develop secondary markets, instead relying on existing destinations. While Asia Pacific countries have limited options for developing airports at secondary cities, this is not the case in Europe. "The fragmentation will occur on the European end, with secondary airports being able to sustain routes to the Asia Pacific," says Meskill. "This would make it possible for hub carriers to develop routes which have a lower passenger volume, that are currently uneconomic."

Unless liberalisation occurs, carriers will primarily operate large aircraft only to major Asia Pacific airports. "The 777 will have 320-330 seats, compared to the 747-300 with about 380-390. Although we offer fewer seats we will be offering greater frequency, and we feel the market will respond to this," says Koster. "We have the ability in our order book to match the market conditions. Because of our lease arrangements we can change our aircraft needs to match the market conditions."

Europe-Asia Pacific competition will occur from more carriers exercising fifth freedom traffic rights. Air New Zealand was granted fifth freedom rights on Hong Kong-London, but has not yet exercised them. Competition is likely to come from smaller carriers attempting to increase their presence; examples include Austrian Airlines, Alitalia and Iberia. A review of the seats deployed on the top Asia Pacific-Europe routes *(see table, this page)* shows that major carriers all use large aircraft, with seating capacity averaging over 350. While the A380 will provide capacity growth for those who have ordered it, carriers will need to increase frequency to meet the regions' growth levels. KLM is already following this principle, by adding frequency on some routes. "We will always seek to offer frequency ahead of pure increased capacity, as the market responds better to frequency. The aircraft options that KLM has allow us to meet the needs of the market, both current and future," says Koster."

Trans-Pacific

While the US has bilateral agreements with many Asia Pacific countries, range restrictions have meant these cannot be offered as non-stop.

Carriers instead channelled passengers through Japan, benefiting from higher yields and fifth freedom traffic, providing the carrier was an incumbent. Incumbent airlines are Northwest, United, Japan Airlines, and All Nippon. These fly to the major west coast gateways, while non-incumbents like American and Delta serve the Asia Pacific from Dallas and Atlanta. With ultra long-range aircraft now available, the physical requirement to channel traffic through Japan has begun to reduce.

Singapore Airlines (SIA) has ordered A340-500s which can reach Los Angeles (8,700nm). Previously SIA had to serve the US via a technical stop.

There are 183 routes, where the great circle distance is over 5,000nm, that are currently served by one-stop services. More than 130 of these are Trans-Pacific routes, equating to 72%. The average frequency on these routes is two flights per day, while the average available seats per departure is 250. This places those routes as immediate candidates for non-stop services with long-range aircraft, and which are still capable of absorbing regional growth. The 777-200LR and A340-500 are both suited for this market, because they will be able to serve countries that are beyond the range of current aircraft types.

Those countries that have open skies agreements with the US can now acquire aircraft that can offer non-stop service. They must be careful to determine the requirements of the aircraft's operation. "The 777-200LR now offers carriers the ability to reach a long way inland on routes from the Asia Pacific to the US," says Meskill. "The question is how far do they want to go? Generally, being able to serve the west coast gateways without a technical stop would be sufficient for most. Moving inland from the gateways reduces your total market, and the value of this has to be evaluated. For now carriers will concentrate on using these aircraft to fly existing routes, since there will be few new destinations added in the near-term."

The first stage of route development will be derived from abandoning selected fifth freedom markets in favour of offering non-stop service with aircraft in the 320-360 seat range. This will see routes to Singapore, Malaysia, and Thailand from Los Angeles and San Francisco. Other routes will also be developed, with countries like Vietnam and Indonesia as potential users of long-range aircraft.

Market development

Irrespective of market liberalisation, inter-region passenger traffic will continue to rise. If the increase occurs with existing bilateral restrictions, then additional aircraft size will be required to absorb growth. Additional frequency on existing routes is also an option. If the markets liberalise, the need for additional capacity will be reduced on all but the heaviest routes. This is due to traffic splintering off into new city-pairs, as has happened on the trans-Atlantic.

Combining and comparing passenger forecasts from IATA, Boeing, and Airbus gives a good indication of market trends over the next 10 years. Trans-Atlantic traffic is predicted to grow by 4.5% annually, trans-Pacific traffic is predicted to grow by 4.8% each year, and Asia Pacific to Europe traffic will grow 4.2% annually. This equates to a compounded growth rates of 49%, 53%, and 45% for

The 777-200 has become one of the major types for the three largest long-haul markets. The same is true for the A330. The use of the A340 has increased on the trans-Pacific and Europe-Asia Pacific, but declined on the trans-Atlantic. The 747 has only marginally increased its presence on the Europe-Asia Pacific market, but declined at the expense of smaller types on most other long-haul networks.

these three markets respectively over the next decade.

To accommodate this growth either aircraft size and/or frequency must be increased. Existing aircraft size *(see table, page 17)* displays the top routes of each of the three main long-haul markets. Frequencies on all routes are at least daily, and in many cases much higher.

Trans-Atlantic growth will be mostly accommodated by further frequency, as the scheduling window makes this a feasible option. The continued development of secondary cities will see further city-pairs opened, reducing the need for higher capacity aircraft than those currently used. Large aircraft are replaced with smaller variants, as more point-to-point services become available. This reduces the passenger volume on larger aircraft, and slows the need for additional frequencies to meet increasing passenger demand.

The average number of daily departures for the busiest routes on the trans-Atlantic is 10, while seats per flight are 300. This suggests that frequency is already high, and passenger growth will be accommodated by capacity increases. Capacity alone will not be sufficient, because compounded growth rates suggest aircraft size will have to increase to about 450 seats in the next 10 years. This suggests 747s and A380s are the only suitable aircraft. Instead, frequency will develop. The 777, Boeing's new super efficient aircraft and A330-300 will be among the most prevalent aircraft types, because they are high capacity, twin-engine aircraft.

Bilateral restrictions and increasing traffic levels on the Asia Pacific-Europe routes suggests the opening of new services will be limited. Carriers will meet this demand in the short term by offering higher capacity aircraft. Average seats per departure is 360, while average daily frequencies are five. Scheduling difficulties means fewer options exist for increased frequency. Average seats per departure will need to increase to about 520, the A380's seat capacity, to meet growth requirements. Several major carriers have already ordered the A380 to accommodate this capacity demand, including Malaysian's recent order for six.

KLM is seeking to serve the market through frequency additions before it seeks additional capacity. "In principle we are already reducing the aircraft size we use by replacing our 747-300s with 777s," says Koster. "This allows us to de-couple routes like Singapore and Jakarta and serve them individually. In the future we will prefer to offer more frequency and more non-stop flights as opposed to adding capacity. That is why we have not ordered the A380."

Trans-Pacific growth will probably follow a pattern similar to the Atlantic, where airlines will schedule smaller aircraft, but offer higher frequency. The development of long-range aircraft like the A340-500 and 777-200LR allow airlines to serve non-stop destinations, rather than carrying passengers via west coast gateways. This will reduce the pressure for further capacity, as large secondary routes are spun off to become distinct city-pairs. Markets will remain limited as Asia Pacific countries have one major city, and a limited number of secondary cities. "The fragmentation of the Asia Pacific market will happen from the European and US ends," predicts Meskill. "More secondary cities will be opened up to serve the Asia Pacific, since it will be economic with 250-300 seat aircraft. With lower capacity aircraft there are several secondary cities that can support service to the Asia Pacific, instead of passengers having to pass through hubs. The Super Efficient aircraft will continue with the same market development principle as the 777. With fewer seats, however, it means that the aircraft will be able to breakeven with a lower volume of traffic; the same principle as was used with the 767."

Aircraft options

As more routes develop, aircraft size generally decreases due to airlines preferring frequency over capacity. The increased market presence of different aircraft types is displayed *(see table, page 17)*. The table shows the increased presence on twin-engine aircraft for routes between the major regions. The table analyses March 2000 and March 2003 schedules.

On the trans-Atlantic, the A330 has increased its frequency by 44%. Frequencies for the 777 have increased by 535%, but this is extraordinary because there were few 777s in operation in 2000. The 767 has decreased in frequency, partially due to the need to secure larger aircraft to meet market demand. The 747 has dropped 24% in frequency over the same period, again partly due to its size not fitting the market's needs. Frequency is used as a measurement rather than ASMs, since the higher seat volume of the larger aircraft would skew the analysis.

For Trans-Pacific routes, the A340, A330 and 777 have all had large increases in frequency. The seats available have decreased in this market due to the effect of removing 747 services. The

increased use of smaller aircraft, especially twinjets, suggests that this market is following the trend of the trans-Atlantic and beginning to move away from Japan-based gateways.

The Asia Pacific-Europe market is the only market that has an increase in 747 use. There is also an increase in other high capacity aircraft like the A340 and 777. This trend displays the dynamics of the Asia Pacific market, where liberalisation is less pronounced and carriers seek to operate to gateways using large capacity aircraft. In all cases *(see table, page 17)* the growth of the twin-jet aircraft has been substantially higher than other aircraft.

The appeal of twin engined aircraft is two fold. Firstly, they offer a sufficient volume of seats to meet most market demands, without having to rely on large connection flows to remain sustainable, unlike widebodies. This allows the majority of traffic to be point-to-point, which carries a higher revenue premium than connecting traffic which is generally lower yield.

Secondly, the economics of operating a twin engined aircraft is superior to operating one with four engines. With the range available through extended range twin-engine operations (ETOPS), and the cost savings of an efficient twin-engine design, these aircraft enjoy a significant operating margin. Their cost per seat is higher, because they have fewer seats, but their trip costs are significantly lower than larger aircraft. The 767 has always been a favourite for route development due to its long-range and operating economics. The A330 is proving equally popular, despite its higher potential lease costs.

Due to the fragmentation of routes, the demand for larger aircraft on the trans-Atlantic is limited. Development of new routes will reduce the demand for larger aircraft further, and airlines will meet increased demand with greater frequency using existing aircraft types. As more routes are developed, capacity demands remain static as less connecting passengers are available to the airline.

As a mature market, fewer new routes are expected to be developed between Western Europe and North America. Trans-Atlantic passenger demand will continue to be met with higher frequencies, not with larger aircraft. Demand to East Europe will probably increase, as Eastern European countries secure aircraft able to operate to the US. Initially the city-pairs served will be limited, requiring larger aircraft like the 777-200/A340-300.

As these countries develop, capacity may follow the pattern in West Europe for more city-pairs. This will probably not occur for many years, making high capacity twin-jets, and the A340, the dominant aircraft type. KLM's seating configuration positions them to serve this market. "Seventeen of the 22 747-400s we operate are combis, with an average seat configuration of 280. We are rationalising our fleet, and this will be complete by 2010. We have four long-haul aircraft types; the 747-400, 747-300, MD-11, and 767. We will reduce this to the 747-400, 777 and A330. This provides us with great seat flexibility, without exposing us to excessive capacity because the majority of 747-400s will be combis."

AIRCRAFT CAPACITY DEPLOYED ON MAJOR LONG-HAUL MARKETS

Market	2000 freqy	2003 freqy	% change	2000 seats	2003 seats	% change
Trans-Atlantic						
A330	1,820	2,621	44%	464,000	705,000	52%
A340	513	518	1%	137,000	134,000	-2%
747	3,733	2,821	-24%	1,465	1,114	-24%
777	692	4,397	535%	194	1,187	513%
Trans-Pacific						
A330	1	97		0	29,000	
A340	204	347	70%	51,000	88,000	72%
747	5,057	3,824	-24%	1,913,000	1,427,000	-25%
767	292	458	57%	67,000	106,000	60%
777	567	1,487	162%	150,000	435,000	189%
Europe-Asia Pacific						
A330	669	1,062	59%	171,000	288,000	68%
A340	399	730	83%	101,000	192,000	90%
747	4,472	4,952	11%	1,683,000	1,874,000	11%
767	680	456	-33%	159,000	101,000	-36%
777	456	892	96%	129,000	261,000	102%

Data is for one month of operation

Summary

As markets liberalise, and frequency restrictions are removed, airlines will seek to serve all but their densest markets with medium capacity aircraft. Dense routes will still require the operation of the 747 and A380, as traffic volumes support their use. Most routes in a liberalised market will require higher frequency combined with lower capacity, reducing airlines' risk.

For markets that meet this requirement, essentially trans-Atlantic, the aircraft available will be the same as currently used. The 777, 767, A330, and Boeing's new Super Efficient, will all compete for the market. Capacity will increase from additional frequency, not from additional aircraft size. This places twin-engine, medium-sized aircraft in a strong position.

Asia Pacific-Europe markets will continue to demand greater capacity, as well as frequency. This is driven by the need for airlines to carry passengers via gateway points due to traffic restrictions. If the market was liberalised more services from secondary European cities will be launched to the major Asia Pacific cities. This is unlikely to happen in the near-term. Therefore, capacity growth will be accommodated by additional frequency and increased aircraft size. The launch of the A380, and the scheduling of additional services, will meet the needs of this market if it does not liberalise. These routes require high capacity aircraft.

The forecast growth rates for each means passenger numbers will continue to grow. The decision to meet this growth with either capacity or frequency will be determined by market liberalisation and to a lesser degree by aircraft range. Long-range aircraft will allow existing trans-Pacific routes served via Japan to be offered as a non-stop service. As routes splinter, the need for mid-size aircraft like the 777 and A340 will offset demand for larger types. Routes between the Asia Pacific and Europe will continue to be gateway restricted, making airlines deploy larger aircraft. AC