The five major intercontinental markets have all experienced consistent traffic and capacity growth over the past eight years. Despite new entrants, incumbent airlines have had to increase aircraft sizes across their networks.

Trends in major long-haul market development

The majority of widebodied aircraft are operated in the five largest intercontinental markets, and the intra-Asia Pacific. The annual capacity provided by airlines in these markets has been analysed over the eight years from 2010 to 2018 to examine patterns in capacity and fleet-planning strategies that airlines have generally followed. This will reveal how capacity has changed, which airlines are adding capacity, and what frequencies and aircraft size (in seat numbers) is being used.

The five intercontinental markets are the Europe-Asia Pacific, Europe-Middle East, Middle East-Asia Pacific, northern transatlantic, and transpacific. The annual number of flights and seats on a uni-directional basis for 2018, and average aircraft size in seat numbers and route length in nautical miles (nm) and kilometres (km) are summarised *(see table, page 6)* for the five intercontinental markets and the intra-Asia Pacific market.

The Europe-Asia Pacific market excludes operations serving Russia and former Soviet Union (FSU) or Commonwealth of Independent States (CIS) countries from European or Asia Pacific countries. This is regarded as a separate market.

Fleet-planning strategies

While airlines will have multiple factors that influence their own capacity and fleet planning strategies, there are several physical and practical constraints that affect all airlines. Some of these, however, have diminished in number and influence over the past 30 years.

Two to four decades ago the five major long-haul or intercontinental markets were mainly restricted through the system of bilaterals and limited traffic rights. This led to a relatively small number of airlines operating a relatively small number of trunk routes. Service frequencies on these routes were limited to less than seven flights per week in many cases. This led to the use of large or ultra-large widebodies. Moreover, airlines were limited to types such as the 747, DC-10-30/-40, and MD-11. Later the A340-200/-300 and 777 were added, and the 767-300ER was used on a few markets that had increased liberalisation of traffic rights, such as the transatlantic, and a growing number of routes serving the Middle East from the late 1980s.

The use of large and ultra-large widebodies was due to a combination of high traffic volumes and a small number of types having the range performance to operate many routes on a non-stop basis.

The large number of time-zone differences in combination with route lengths on many of these markets has always limited the number of daily flights on these routes. Airlines naturally want to choose attractive departure and arrival times. Taking into consideration flight time, time-zone differences, maintaining attractive arrival and departure times, and airport curfews, many airlines are limited to two or three daily frequencies on the longest Europe-Asia Pacific, transpacific and northern transatlantic routes. Shorter routes on the Europe-Middle East and Middle East-Asia Pacific markets can sustain higher daily frequencies and attractive departure and arrival times, due partly to the smaller number of time zone changes.

The issue of higher frequencies applies more, however, to airlines operating in these two markets on a point-to-point service. The three big Middle East carriers have used their respective hubs in the Persian Gulf to establish comprehensive intercontinental networks. These are used as interlining points for flights serving western cities, mainly in North America and Europe, and points in the eastern hemisphere, mostly on the Indian sub-continent and the Asia Pacific. As a result of the long flight times and number of time-zone changes, and an allowance of sufficient times for passengers to make transfers and flight connections at its Dubai hub, Emirates has been restricted to frequencies of only once or twice daily services on many routes. The airline has, therefore, needed to operate a large number of high-capacity A380s to provide sufficient capacity to meet demand, while operating at relatively low frequencies.

The introduction of new long-range aircraft over the past 25-30 years has increased airlines' flexibility with respect to capacity and fleet-planning, as well as market entry. Bilateral agreements have gradually been expanded and become more relaxed.

Many new aircraft types that have become available to airlines include aircraft that are smaller than the DC-10-30 and MD-11. These include the A330-200, 787-8 and -9, and the A350-900. These new aircraft also have total unit costs per available seat-mile (CASM) that are comparable with larger types. Airlines have used the new types to enter routes with lower levels of demand, as well as to adjust schedules from frequencies of three or four weekly flights to daily services. This has

All top 5 major intercontinental markets have grown at steady and consistent rates over the past eight years. Despite the trend over the past 25 years of seeing several successful new entrants and new routes being opened, airlines have had to increase average aircraft capacity and across their route networks.

generally led airlines away from large and ultra-large types that are only suited to a minority of airlines that operate from the world's largest hubs. The smaller widebodies have allowed many airlines to match seat numbers with demand levels on a larger number of routes at more attractive service frequencies.

Moreover, an alternative to the 747-400 has become available via the 777-300ER, which has 20-50 fewer seats, and has lower cash operating costs. The 747-8i and A380 provide airlines with ultra-high capacity. These can be used where airlines are constrained on their ability to increase service frequencies, only wish to operate at limited frequencies, or have sufficiently high enough demand levels to fill these aircraft.

Changing markets

In addition to the need for airlines to adapt to new aircraft types and operate at more optimised service frequencies on as many routes as possible, other factors have influenced capacity and fleet-planning strategies. These include changing traffic volumes in major markets, and the formation and consolidation of airline alliances.

The continued strong growth of the three large Middle Eastern airlines, mainly through the strategy of attractive interlining fares between countries in the western and eastern hemispheres, has drawn large volumes of passengers away from direct routes between Europe and the Asia Pacific, and on the transpacific market.

Another macro development in the market has been the transformation of the transpacific market. This was dominated for several decades by Japan Airlines (JAL), Pan Am, and Northwest, and later by All Nippon Airways (ANA). These airlines had fifth-freedom rights between Japan and other Asia Pacific countries. Until the arrival of ultra-long-haul aircraft in the early 1990s, airlines were required to operate between North America and the Asia Pacific via Tokyo for refuelling stops. This situation favoured the four airlines with fifth-freedom rights. In this situation Pan Am, later replaced by United, Northwest, JAL and ANA had large transpacific networks and long-range fleets to match.

The advent of ultra-long-range types and the gradual liberalisation of bilaterals led to more competing airlines being awarded traffic rights, particularly in the US-China market. This development subsequently drew traffic away from fifth-freedom routes that transit via Japan.

This development further continues as more medium-sized widebodies, such as the 787-8/-9 and A350-900/-1000, come into service. This has seen a decline in the transpacific route networks of the four airlines that dominated the market, and the use of smaller widebodies on most routes instead of a large number of 747s and ultra-large types.

Major markets

Market sizes can be gauged by several criteria, including: annual numbers of flights, seats, and available seat-miles (ASMs) or available seat-kilometres (ASKs). The number of annual seats directly indicates the demand levels on a route or in a market. The number of ASKs/ASMs can give a distorted indication of market size, since average route length is a factor. The average route length in each market is another useful criterion.

Middle East-Asia Pacific

The Middle East-Asia Pacific has not only grown to be the largest of the world's five major intercontinental markets, but is also one of the fastest growing. Total annual one-way seat capacity is almost 62 million seats *(see table, page 6)*, provided by 252,000 annual flights, with an average size of 245 seats and average route length of 4,278km or 2,310nm. Total seat capacity has more than doubled in eight years since 2010 *(see table, page 6)*.

This market is split into three sub-markets of routes between the Middle East and Indian subcontinent, between the Middle East and Russia and CIS, and the Middle East and countries in the Asia Pacific. These include China and further away in Australasia.

The routes between the Middle East and the Indian subcontinent include shorter routes, with those between the Persian Gulf airports and hubs and Pakistan being 904-1,130nm. This sub-market has a large number of operations by several young and new carriers that include Flydubai, Air Arabia, Shaheen International, Spicejet and airblue. These relatively young airlines all operate short average route lengths.

This sub-market is the largest of three sub-markets, with one-way seat numbers having increased by a factor of 1.9 to 35.4 million seats per year since 2010 *(see table, page 6)*. Average route lengths are 1,500nm, and are served by airlines based

SUMMARY OF TOP 5 GLOBAL INTERCONTINENTAL MARKETS 2010 & 2018

Market	2010 data No. of annual flights	2010 data No. of annual seats	2010 data Average aircraft size - seats	2018 data No. of annual flights	2018 data No. of annual seats	2018 data Average aircraft size - seats	Capacity increase 2010 to 2018	Change aircraft seat size
Europe-Asia Pacific continent								
Europe-Asia Pacific	75,765	22,945,107	303	107,343	32,130,733	299	1.40	-4
Europe-Russia & Cis	102,875	15,593,704	152	141,228	23,962,345	170	1.54	18
Sub-Total	**178,640**	**38,538,811**	**216**	**248,571**	**56,093,078**	**226**	**1.46**	**10**
Europe-Middle East	107,796	22,837,987	212	208,345	49,828,949	239	2.18	27
Middle east-Asia Pacific continent								
Mid East-Asia Pacific	35,073	10,708,585	305	68,257	23,586,183	346	2.20	41
Mid East-Indian Sub-Cont	91,012	18,641,394	205	166,655	35,442,879	213	1.90	8
Mid East-Russia/CIS	4,308	613,352	142	17,320	2,736,271	158	4.46	16
Sub-Total	**130,393**	**29,963,331**	**230**	**252,717**	**61,979,831**	**245**	**2.07**	**15**
North transatlantic	150,829	38,554,806	256	202,040	58,239,416	288	1.51	32
Transpacific	68,336	19,242,160	282	108,780	30,299,000	279	1.57	-3
Total 5 Long-Haul Markets	**635,994**	**149,137,095**	**234**	**1,020,453**	**256,440,274**	**251**	**1.7**	**17**

in the Indian subcontinent, and some relatively young airlines in the Persian Gulf.

The airlines providing the largest capacities are Emirates, Air India/India Express, Qatar Airways, Saudia, Jet Airways, Etihad and Air Arabia. These seven carriers have also enjoyed some of the highest growth rates since 2010. In 2018, Emirates will provide almost 5.8 million seats, Air India/Air India Express 3.7 million, Qatar Airways almost 3.2 million, Saudia about 2.8 million, Jet Airways about 2.5 million, and Etihad about 2.3 million seats. Combined, these six airlines provide more than 58% of all capacity.

Flydubai had only a small operation in 2010, but in eight years has increased its operation to 7,637 flights and 1.39 million seats. Air Arabia has increased its operation by a factor of 1.67 to 2.0 million seats.

One characteristic of the development of this market has been the increase in average aircraft size operated by the big airlines. Emirates, Qatar Airways, Etihad, Jet Airways and Saudia have all increased aircraft size. Emirates uses exclusively 777-200s and -300s and has increased average aircraft size by 84 to 390 seats, indicating it could start using A380s in the next 10 years. Etihad and Qatar Airways both use a mix of A320s and widebodies, including 777-300ERs, and Qatar has seen average aircraft size increase by 43 seats.

Jet Airways also uses a mix of narrowbodies and widebodies, with the proportion of 777-300ERs increasing and average seat size rising by 31 seats. Saudia has the most extensive route network to the Indian subcontinent, and operates exclusively with widebodies that include the 777-300ER and 747-400, with seat capacities exceeding 400.

On a macro level, the portion of total seat capacity that is provided by the 777-300ER and three ultra-large types of the 747-400, 747-8 and A380 has increased from 18.4% to 26.7% since 2018. The 777-300ER provides the largest number of seats of these four types, while the use of the 747-400 has declined by about 85%.

The second sub-market of the Middle East-Russia/CIS is the fastest growing of all intercontinental markets, seat numbers having increased by a factor of 4.46 since 2010 to 2.74 million *(see table, this page)*.

The third sub-market is between the Middle East and the other countries of the Asia-Pacific. This includes the longest routes from the Persian Gulf and states of Saudi Arabia and Kuwait to destinations such as Tokyo, Seoul, Beijing, Singapore and Hong Kong. This sub-market also accounts for the second-largest amount of capacity at 23.59 million seats, 68,000 flights, and an average aircraft size of 346 seats. This is the largest average aircraft size of all intercontinental markets.

The number of one-way annual seats has increased by a factor of 2.2 since 2010, while the number of flights has increased at a lower rate. This indicates that service frequencies have become limited on some routes, requiring larger types of aircraft to be deployed.

The three large Persian Gulf carriers, Emirates, Qatar Airways and Etihad, provide the largest amounts of capacity in this market. Emirates provides 8.8 million seats on a one-way basis and has an average aircraft size of 439 seats, Qatar Airways provides 5.6 million seats and has an average aircraft size of 334 seats, and Etihad provides more than 2.8 million seats and has an average size of 318 seats. These three airlines combined provide 73% of the total capacity, with Emirates by itself accounting for 37% of the entire market. Moreover, these three carriers account for a high portion of capacity compared to 2010.

Emirates uses exclusively 777-200LRs, 777-300ERs and A380s in this market, and average aircraft size has increased by 62 seats to 439. This indicates that the carrier will use an increasing portion of A380s in this market.

Qatar Airways has had the largest increase in capacity, and operates with a mix of widebodies that includes the A380. Average aircraft size has increased by 54, indicating that it will also need to increase its utilisation of the largest types.

Etihad similarly operates with a mix of widebodies, but has had a modest increase in average size of 17 seats to 318.

Oman Air, Mahan Air and Philippine Airlines provide another 2.9 million seats, another 12% of the total market. These six airlines have also grown capacity by factors of 2.2-6.8 since 2010, and so have increased their market shares. Air China has grown its capacity by a factor of almost five.

There are several new entrants that include AirAsia X, Sichuan Airlines and Qantas, which now uses the A380 to transit via Dubai rather than Singapore on its Australia-Europe routeings.

In contrast the major Asia Pacific carriers of Garuda Indonesia, Cathay Pacific, China Southern, Thai Airways International, Air China, Korean Air, Singapore Airlines, AirAsia X, Qantas,

ANNUAL SEAT CAPACITY MILLIONS PROVIDED BY LARGE & ULTRA-LARGE AIRCRAFT IN TOP 5 INTERCONTINENTAL MARKETS

	2010 DATA							2018 DATA						
Region	777-300ER	747-400	747-8	A380	Total	Total market	% of Total	777-300ER	747-400	747-8	A380	Total	Total market	% of market
Europe-Asia	3.52	6.06	0.0	0.95	10.53	22.17	47.5	8.90	0.62	0.73	3.11	13.4	32.13	41.6
Europe-Middle East	3.80	0.63	0.0	0.51	4.90	22.69	21.6	7.48	0.41	0.0	8.20	16.0	49.82	32.3
Middle East-Asia Pacific	4.02	0.73	0.0	0.60	5.35	10.70	50.0	8.61	0.21	0.0	5.92	14.7	23.58	62.5
Middle East-Indian	2.20	1.20	0.0	0.0	3.38	18.36	18.4	9.12	0.16	0.0	0.18	9.46	35.44	26.7
North transatlantic	1.60	5.67	0.0	0.16	7.42	38.10	19.5	2.77	4.07	0.90	2.70	58.2	58.23	17.9
Transpacific	3.10	6.08	0.0	0.19	9.40	19.0	49.4	2.7	0.51	0.25	1.67	5.16	30.30	17.1
Total	14.7	14.3	0.0	1.47	40.1	131.06	31.3	39.6	6.00	1.87	21.8	69.3	229.53	30.2

Malaysia Airlines and China Eastern all provide a small portion of the capacity. Each airline only provides 38,000-282,000 seats per year.

The Middle East-Asia Pacific market has experienced the largest increase in the use of the four largest types: the 777-300ER, 747-400/-8 and A380. The portion of total capacity provided by them has increased from 50% to 62.5% since 2010.

Europe-Middle East

The Europe-Middle East is the second main market serving the Middle East, while there are also routes between the Middle East and North America, and smaller networks between the Middle East, and Africa and Latin America.

The Europe-Middle East market is the fourth-largest intercontinental market, but is the fastest growing. This has an annual total of 208,345 flights and 49.83 million seats. Average aircraft size is 239 seats, and average route length is 3,688km (1,991nm) *(see table, page 6)*. This market has the shortest routes of the top five largest long-haul markets.

Similar to the Middle East-Asia Pacific market, Emirates is the dominant carrier, providing 26,532 flights and 11.84 million seats, equal to 12.7% and 23.7% of the market total.

The other largest airlines are Qatar Airways (27,356 flights and 6.85 million seats), Turkish Airlines (20,790 flights and 4.42 million seats), Etihad (10,228 flights and 3.08 million seats) and El Al (12,346 flights and 2.23 million seats).

The total seat capacity in the Europe-Middle East market has grown by a factor of 2.18, equal to an average annual compound growth rate of about 10%. The top five airlines have increased their seat capacities by a factor of 2.24-3.27, higher than the overall market. More than 50 airlines with small annual capacities of up to 350,000 seats have left the market since 2010. Moreover, many established airlines such as Gulf Air, British Airways (BA), Lufthansa, MEA, Royal Jordanian, Air France, KLM, and SWISS have either grown at less than the average for the market, or have even decreased the size of operations in this market since 2010. Many of these carriers have seen a commensurate drop in aircraft size over the same period.

The large amount of capacity provided by Emirates is reflected in its expansive route network from Dubai to Europe. Its capacity has grown from 5.3 million to 11.84 million seats since 2010, a growth factor almost in line with the market.

This market is one of Emirates' largest, and it operates to 41 European destinations, solely with the A380 configured with 489 seats and the 777-300ER with 400 seats. Capacity and operation equates to an average of 647 daily flights and 288,000 seats per year for each route. Average seat size across the network is 446, the largest in all its markets. More than half the seats and half the flights are operated with the A380.

The largest routes for Emirates in this market are to the United Kingdom. It serves five main destinations including London Heathrow (LHR) and London Gatwick (LGW), operating six and three daily flights with the A380. It also services Manchester (MAN) with three daily A380 operations, Birmingham with two daily A380 services, and Glasgow with two daily 777-300ER services. The capacity provided by Emirates on these routes serving the UK outweighs BA's capacity between the UK and Dubai by a factor of 2.5.

Emirates also has high-capacity operations to Frankfurt, Paris Charles de Gaulle (CDG), Milan, Amsterdam, Rome, Istanbul and Munich.

Qatar Airways has increased its capacity by a factor of 3.27, the highest level of the top five airlines in the market. Qatar increased annual seat capacity from 2.092 million to 6.85 million over the eight years to 2018, and average aircraft size increased by 19 seats to 250.

Qatar Airways uses a cross-section of all types in its fleet, including the 777-300ER and A380.

Despite being the smallest of the big three Persian Gulf carriers, Etihad has had one of the highest rates of increase in capacity. While it uses a variety of narrowbodies and widebodies that include the A380 in this market, its average aircraft size has increased by 83 to 301 seats with the inclusion of the 787-9 with a 299-seat configuration.

The growth and increasing domination of the big three Persian Gulf carriers in this market is illustrated by a comparison of annual seat capacity between their three respective hubs and all the points in the UK with that of BA. BA only flies to Dubai, Abu Dhabi and Doha from LHR, and has an annual capacity of 370,000 seats with an average of 4.4 daily flights. Most services are with the 787 and 777-200, and average aircraft size is 230 seats.

In contrast, Emirates, Etihad and Qatar Airways have a combined annual capacity of 5.0 million seats from their hubs to LHR and LGW, plus four other UK gateways. These three carriers provide average daily frequencies of 13 services, and average aircraft size is 416 seats.

An interesting airline in this market is Turkish Airlines. It is the third largest airline in the market, and its development and growth should continue with the opening of Istanbul's new major airport AT Arnavutkoy in eastern Istanbul, to replace Ataturk (IST) airport.

Turkish operates from several Turkish airports. In total it provides 4.4 million seats with nearly 21,000 annual flights. Annual capacity has grown by a factor of 2.74, and average aircraft size has grown by 46 seats to 213. More than 3.8 million seats per year are from IST. It flies to 29 destinations, generating almost 17,000 flights. It operates 737-800s, A320s, A321s and A330s and has an average aircraft size of 226 seats. Main destinations include Amman, Doha, Abu Dhabi, Jeddah, Kuwait, Muscat, Riyadh and Tel Aviv.

Turkish also operates to 11 destinations from Istanbul's secondary airport Sabiha Gokcen (SAW).

There are several airlines that are

relatively young, but have attained large operations when compared to incumbent European and Middle East airlines. Turkish carrier Pegasus provides an annual total of 6,072 flights and 1.13 million seats to several destinations, mainly from SAW.

Flydubai, which started operations in 2009, operates to almost 30 destinations in Eastern Europe and Russia and the CIS from its Dubai hub with 737NG and MAX aircraft.

Atlasglobal started operations in 2001, and operates from IST to major Middle East destinations with 737 and A320 family aircraft. It has grown by a factor of 6.9 since 2010. Air Arabia operates from Sharjah to a small number of Russian and Turkish destinations with A320s.

The Europe-Middle East market is interesting in that the shares of capacity provided by narrowbodies and widebodies have not changed since 2010. The share of widebody capacity provided by the four large and ultra-large types has, however, increased by more than 10 percentage points to 32.3%. The biggest contributor to this increase is the A380, which increased its annual seat numbers in the market from about 510,000 in 2010 to 8.2 million in 2018, an increase by a factor of about 16.

While the big three Persian Gulf carriers, Turkish, and many other fast-growing airlines, such as Aeroflot, have seen large increases in average aircraft size, some long-term incumbent airlines, such as BA, Lufthansa and Gulf Air, have seen a reduction in aircraft size as competition has steadily increased. A few others, such as Royal Jordanian, Air France and Kuwait Airways, have seen small increases.

Europe-Asia Pacific

The Europe-Asia Pacific market is one of the mature intercontinental markets. Having been the largest in 2010, it is now the third-largest. The Middle East-Asia Pacific and northern transatlantic markets have overtaken Europe-Asia Pacific due to their sustained high average annual growth rates of 9.5% and 5.3%.

The Europe-Asia Pacific market has grown at an average annual compound rate of 4.8%, in line with the global annual industry. This has seen seat capacity grow by a factor of 1.46 over eight years to 56.1 million seats.

The Europe-Asia Pacific market is sub-divided between routes from both Europe and the Asia Pacific countries that serve the territories and states in Russia and the CIS; and the routes that operate between West and East Europe, and the Asia Pacific. This latter market includes routes between Europe and the Indian sub-continent, and also has the second-longest routes after the transpacific.

The Europe-Asia Pacific sub-market is the larger of the two. This has grown at a mature average annual rate of 4.2%, with annual seat numbers increasing by a factor of 1.40 since 2010. This has taken total seat numbers to 32.1 million. Average aircraft size has hardly changed.

The Europe-Asia Pacific market has several groups of airlines. The first is a large number of incumbent and established carriers that have grown operations at less than the average since 2010. This includes Lufthansa, BA, Air France, Thai Airways International, Singapore Airlines, KLM, Air India, ANA, JAL and China Airlines.

Many of these airlines have seen average aircraft size drop in parallel with a decline in overall seat capacity. These include BA (down by 22 seats), Cathay Pacific (down by 65), Singapore Airlines (down by 46), Air India (down by 55), ANA (down by 127), and JAL (down by 106). The main explanation for this is a readjustment of capacity in the face of increased competition from the big three Persian Gulf carriers that has drawn away higher rates of traffic growth from the Europe-Asia Pacific market. This is by offering the alternative services that transit via their Persian Gulf hubs at competitive fares. In addition to relatively small reductions in total seats, these incumbent carriers have introduced relatively high operating frequencies.

Emirates and the two other major Persian Gulf carriers dominate the capacity provided on the Europe-Middle East, and Middle East-Asia Pacific markets. As an example, Emirates' capacity on routes between its Dubai hub and the various points in the UK is 2.5 times that provided by British Airways.

While BA has deployed the A380 on its two trunk routes from LHR to Singapore and Hong Kong, it has replaced 777s and 747-400s with the 787-8 and -9 on many routes, such as LHR-Tokyo Narita (NRT).

Cathay Pacific has replaced its 747-400s and A340-300s with 777-300ERs and A350-900s, while also adding frequencies to existing routes and opening several new services to European cities.

With the phasing out of its 747-400 fleet, Singapore Airlines has replaced it with A350-900s and 777-300ER, and also added some new European destinations.

Air India has followed a similar strategy to Cathay Pacific and Singapore Airlines. It has replaced the 777-200ERs and -300ERs it was operating on its network to Europe with 787-8s, and also opened new routes to several European cities.

ANA has opened two new European routes from Tokyo, changed many of its operations from NRT to Haneda (HND), and replaced its 777-300ERs and 747-400s with 787-8s and -9s.

JAL has reduced seat capacity by 29% since 2010, following several problems that included operating under bankruptcy protection for more than two years. Reductions have included removing three European destinations from its network from Tokyo, simplifying its network to mainly daily services, and replacing its 747-400 and most of its 777-300ER capacity with 787-8s and -9s.

Other airlines, including Lufthansa, Air France, Thai Airways International and EVA Air have increased average aircraft size. These are, however, relatively small aircraft size increases. Lufthansa's increase in average aircraft size is mainly due to its replacing A340-300s (configured with 223 seats) and A330-300s (configured with 221) with reconfigured A330-300s with 255 seats and reconfigured A340-300s with 279 seats. It has also replaced significant 747-400 capacity with the 747-8i, which has about 20 more seats. Lufthansa has also deployed more A380 capacity since 2010.

Air France's increase in average aircraft size of 24 seats is due to a reconfiguration of its 777-300ER fleet from 310 seats to 381.

A small number of incumbents have grown at a similar rate to the average. These include Korean Air, SAS and EVA Air. Others have declined operations in this market, in particular Virgin Atlantic, Malaysia Airlines and Qantas. Qantas has re-routed its Australia network from transits in Singapore to transits via Dubai.

Airlines that have grown operations at a faster than average pace, and which have consequently increased their market shares, include Turkish, Air China, Finnair, Jet Airways, China Eastern, Asiana, Hainan Airlines and China Southern. The four Chinese airlines in this group have increased their seat capacities by factors of 2.43-3.33, and increased average aircraft size by 21-31 seats.

The Europe-Asia Pacific market has seen a drop in the portion of total seats provided by the four large and ultra-large types by about six percentage points to 41.6%. The fall in 747-400 capacity has been only partially replaced by 747-8, 777-300ER and A380 capacity. Over the same period, 777-200ER capacity has been replaced by that provided by the 787-8/-9 and A350-900.

A final group of airlines is those new carriers that have entered the market since 2010, or airlines that have re-entered the market, and grown their operations to appreciable levels. Airlines that have re-entered the market include Garuda Indonesia, Philippine Airlines and Iberia. One new entrant is Norwegian, which operates services from Scandinavia to Bangkok with 787-9s with high-density seating configurations.

One main factor affecting the capacity and fleet-planning strategies of the main market incumbents has been the interlining services at attractive fares offered between Europe and the Asia Pacific by the big three Persian Gulf airlines via their respective hubs. These are high-volume services between 10 or 11 major European cities and airports, and eight major Asia Pacific airports. Analysis of total capacity provided by the big three indicates that much of the growth that may have been absorbed by direct and non-stop services between Europe and the Asia Pacific was, in fact, won by the big three Persian Gulf carriers on their interlining services.

Northern Transatlantic

The northern transatlantic market has become the second-largest intercontinental market. Annual one-way seat capacity has grown by a factor of 1.51 to 58.2 million seats since 2010 *(see table, page 6)*. This is equal to an average annual growth rate of 5.3%. This is in line with, or higher than, the overall market growth rate, which is perhaps surprising to some, given that the northern transatlantic is the most mature intercontinental market.

Commensurate with this high growth rate has been an increase in average aircraft size by 32 seats from 256 to 288. This is an interesting development. By the mid-1990s the 767 had become the most used aircraft in the market, and with the advent of widebody twins and extended-range twin engine operational performance standards (ETOPS), average aircraft size declined after a sustained period when the market was dominated by the 747 and DC-10-30. Smaller widebody twins and ETOPS, and the effects of liberalised transatlantic bilaterals, allowed route networks in this

Because of the retirement of the 747-400 in large numbers and the lack of a direct replacement, many airlines have increased the seat capacities of their larger widebodies. One example is Air Canada, which has increased seat numbers on its 777-300ERs from 349 to 400.

mature market to develop into an increased number of airport-pairs and service frequencies. This has been aided by an increased variety of medium-sized widebody twins that include the 767-400, A330-200, 777 and 787.

The process of adding frequencies and airport-pairs has now matured, although there are a large number of new entrant carriers over the past eight years that have increased competition levels on mainly existing routes.

Continued growth on the northern transatlantic has clearly seen a need for an increase in average aircraft size. Another interesting development is that, despite the increase in average aircraft size, the portion of seats provided by the four large and ultra-large types has decreased by a small factor of about 1.5 percentage points since 2010. It is the one market where the 747-400 still accounts for a high portion of that provided by ultra-large types.

Over the same period, however, the portion of seats offered by medium-sized widebodies that include the 787-8/-9, A330, A340, A350, MD-11 and 777-200 variants has increased from 47.8% to 54.2%. The A330-200 and -300 have added to the capacity provided by 777-200 variants. In the meantime, the A300-600, A310 and 767 variants account for a smaller portion of seat capacity and operations. Capacity provided by the 767 variants has fallen by about 2 million seats, while the total market has grown by 20 million seats.

The largest airlines in the market are the big three US carriers -- Delta Air Lines, United Airlines and American Airlines -- and BA and Lufthansa. These five airlines account for 45% of total seat capacity. Other large incumbents include Air Canada, Air France, Virgin Atlantic and KLM.

With the exception of Air Canada, eight of these nine airlines have all increased their seat capacities at less than the average growth rate of the entire market. Despite this, most, except BA and Virgin, have increased average aircraft size.

The annual capacities for Delta, United and American in 2018 are compared to the combined capacities of Delta and Northwest, United and Continental, and American and USAirways in 2010. Delta and Northwest merged in 2008, United and Continental merged in 2010, and American and USAirways merged in 2013. These three airlines have only increased their annual capacities by 1-14%, but have still seen average aircraft size increase.

United and American have seen a small increase in average aircraft size, while they operate with a mixed fleet of 757-200s and multiple widebody types. Both have reconfigured many of their aircraft with higher seat numbers. Air Canada has also reconfigured many of its aircraft types with higher seat capacities, and increased average aircraft size by 52 seats.

There are several fast-growing incumbents. The most notable are Turkish Airlines, Air Transat, Aer Lingus, Icelandair, SAS, Aeroflot and TAP Air Portugal. These have increased annual seat capacities by a factor of 1.74-4.59 since 2010, while the number of services has increased at lower rates and so average aircraft size has increased.

Turkish Airlines has achieved the highest growth rate in capacity of all airlines in the market, reaching an annual capacity of 1.33 million seats. It operates mainly daily services to nine US and two Canadian gateways from Istanbul, using the A330-300 or 777-300ER.

In addition to incumbent airlines, there are some notable new entrants in the market. These include three Norwegian group airlines, which have established the largest operation since starting transatlantic services in 2013. One-way seat capacity for 2018 is 2.77 million and 9,271 annual flights. This exceeds Virgin Atlantic's annual capacity by about 300,000 seats, and is also equal to 53% of BA's annual seat capacity.

The Norwegian group operates 787-8s and -9s with 291- and 344-seat configurations, and some 737-800s, making its average aircraft size larger than BA's on its northern transatlantic services. The three airlines in the group operate from mainly London Gatwick (LGW), Stockholm, Copenhagen, Oslo and Barcelona to 14 points in the US, including several major gateways. The largest operation is from LGW.

Other significant new entrants include Icelandic carrier Wow Air. This carrier established a North Atlantic interlining operation via Keflavik in 2012, and operates with A321s. Its annual seat capacity in 2012 reached 761,000 seats, which is larger than Alitalia's annual capacity in the market.

Emirates entered the market in 2013 and 2017 with daily services each from Milan and Athens to New York using the 777-300ER and A380.

Transpacific

The transpacific market is the third-fastest growing intercontinental market since 2010, after the Europe-Middle East and Europe-Asia Pacific markets. Annual one-way capacity for the transpacific market in 2018 is 30.3 million seats. This is a 57% increase from 2010, and represents an average annual compound growth rate of 5.8%. This is higher than the average annual increase for the overall industry during the period.

Despite the high growth rate of the

past eight years, the transpacific is still the fifth-largest of the main intercontinental markets. Average aircraft size has decreased by just three seats to 279.

Developments in fleet types used have included a large reduction in the use of the four large and ultra-large aircraft types since 2010. Capacity provided by the 747-400, which was the dominant type in 2010, has declined from about 6.1 million seats to 0.5 million seats in 2018. Over the same period, capacity provided by the 777-300ER has decreased by about 0.4 million to 2.7 million. These reductions have only partially been offset by a small amount of capacity provided by the 747-8, operated by Korean Air, and about 1.7 million seats provided by the A380.

In parallel with this development has been the increase in capacity provided by medium-sized widebodies, such as the 787-8/-9 and 777-200ER/-200LR from 17.1% to 38.8% of total market capacity. The 787 accounts for 21.3% of capacity in 2018, and the A350-900/-1000 accounts for 4.7%.

As described, the routes between the US and Asia Pacific were dominated by United, Northwest, JAL and ANA, which had traffic rights via the Japanese refuelling points until the early 1990s. Traffic rights and bilateral liberalisation have steadily increased since, and more airlines have been able to operate a larger number of non-stop routes. This has consistently reduced the dominance of these four carriers, while allowing many others to offer a large number of long-awaited non-stop services across the Pacific Ocean.

The relative decline in the four main airlines is reflected by the fact that Delta's operation in 2018 is about 20% smaller than the combined Delta and Northwest operation in 2010. JAL's operation has only increased by 5% since 2010, partly explained by the carrier's entering bankruptcy protection in January 2010, and emerging in September 2012.

One of several problems facing JAL was the operation of the world's largest 747 fleet. Its long-haul fleet has since been reduced to about 110 widebodies, the majority of which are smaller 767-300s and 787s.

ANA has taken advantage of JAL's re-sized operation, and has increased annual seat capacity by a factor of 2.34 since 2010 to 1.41 million seats. ANA has also increased the number of service frequencies at a higher rate than seat capacity by swapping a fleet of exclusively 777-300ERs for a mix of 787s and 777-300ERs with a smaller number of seats in a new configuration. Another factor in ANA using a smaller average aircraft size is the redeployment of some intercontinental services from NRT to HND.

Despite this general capacity and fleet-planning strategy, ANA will be taking delivery of three A380s in 2019 for use on services to Honolulu.

United's transpacific capacity has grown at a lower rate than the entire market, increasing by 23% over the combined operations of United and Continental in 2010. United has consolidated capacity on existing routes over the eight years since 2010, but has also opened new routes Denver, Honolulu and San Francisco. It has removed all its 747-400s, and supplemented many routes with the introduction of the 787-9. The overall effect has been for United to increase average aircraft size by about 60 seats.

An interesting side development is the size of United's operations serving Guam, since the merger with Continental included the absorption of Continental Micronesia. Capacity in this operation has dropped by about 30% since 2010.

In contrast to the four major carriers, other incumbent airlines have seen large increases in their transpacific operations.

Lufthansa has managed to add capacity on routes across its long-haul network by reconfiguring several types with higher seat capacities. It increased seat numbers on its A340-300s by up to 58.

One example is Air Canada, whose capacity in the market increased by a factor of almost 5.0 over eight years from 426,000 seats to 2.09 million seats. Air Canada has gone from operating routes to four Asia Pacific cities from Vancouver and six from Toronto using a mix of 777-200LRs and 777-300ERs, to increasing the number of cities from these two hubs to 123 and seven in 2018. While Air Canada has introduced 787-9s with fewer seats than the 777-200LR, the carrier has increased the seat capacity of its 777-300ERs by 51 seats to 400, and introduced new services from Montreal and Calgary. Overall, its average aircraft size has increased by 40 seats to 322.

American Airlines has also had a high growth rate, with capacity increasing by a factor of 2.19 to 1.49 million since 2010. This is explained by a large expansion in operations, particularly in the opening of new routes from Los Angeles and Dallas /Fort Worth. American has used the 787-8 and -9 configured with 226 and 285 seats.

Other airlines that have increased operations at high rates over the past eight years are EVA Air, China Eastern, Hawaiian Airlines, Hainan Airlines, China Southern, China Airlines and Air India. EVA Air, for example, has increased annual seat numbers by a factor of 2.09 and Hainan Airlines by a factor of 16.

EVA Air's growth is mainly explained by consolidating operations to major US gateways by increasing services from mainly three and four weekly frequencies to daily services, and to two or three daily services from daily or twice daily services on heavier routes. EVA Air has replaced its 747-400s with 777-300ERs over the same period, but 777-300ER cabin layouts have been reconfigured to as many as 353.

China Eastern has added frequencies to US gateways and opened new routes, while phasing out its A340-600s and replacing them with A330-200s and 777-300ERs.

Hainan started operations from Beijing to Seattle and Vancouver in 2010 with the A330 and A340. After eight years of development, Hainan Airlines has grown its operation to 15 routes with three to seven weekly frequencies on most routes and has deployed the 787-8 and -9.

China Southern has increased its transpacific operation by a factor of 9.8 over eight years, equal to an average annual growth rate of 33%. In 2010 China Southern had one route from Guangzhou to LAX with a limited frequency using a 777-200ER. By 2018 its network had grown to six routes, many with more than seven weekly services. China Southern operates the A380 on a daily service to LAX, and the 787-8, A330 and 777-300ER to other destinations.

Many airlines in the transpacific market operated the 747-400 in 2010. This included United, Cathay Pacific, Air China, Air New Zealand, Asiana, Northwest, EVA Air, JAL, Korean Air, Philippine Airlines and Qantas. Only Air China, Asiana and Qantas operate the 747-400 in 2018. Asiana has almost phased out the last of its fleet, and Qantas will retire its last 747s in 2020. Korean Air has retired all of its 747-400s, and replaced them with 747-8s and A380s.

Summary

It is clear that high traffic growth rates in all five major long-haul markets have been sustained by consistent increases in seat capacity *(see table, page 8)*. The average aircraft size has also increased in most of these markets. On only the Western and Eastern Europe-Asia Pacific, and the transpacific markets has average aircraft size declined by just a few seats. This development indicates a minimal effect of new routes and new entrants resulting in established airlines needing to downsize.

Over the same period most ageing fleets of 747-400s have been phased out, but they have been replaced with large and other ultra-large types. The portions of total seat capacity provided in these markets by large and ultra-large types has hardly changed between 2010 and 2018. The capacity left by the 747-400 fleet has therefore been replaced proportionately by the 777-300ER, 747-8i and A380.

In addition to this, airlines have found other techniques to add seat capacity once service frequencies have been optimised. The 747-8i and A380 is clearly too large for many airlines. Several carriers have therefore taken the only remaining option of increasing seat numbers on smaller types. Examples are Lufthansa increasing its A330-300 and A340-300 seat counts by 34 and 58, and its 747-400 by 27 seats.

Many airlines operating the 777-300ER have increased economy-class configuration from nine- to 10-abreast, and so gained seat number increases. EVA Air increased its 777-300ER configuration by seven, and Air France has increased the aircraft from 310 to as high as 381. Turkish Airlines increased the 777-300ER configuration by 24 seats, while Air Canada increased from 349 to 400. American and United both increased their 777-200ER seat counts by 26 and 13.

Continued growth will increase the need by a larger number of airlines for larger aircraft types on more of their routes. The advent of the 777-9X will help this issue, but demand for an aircraft with capacity in the same bracket as the 747-8i and A380 is likely to steadily increase over the next 10 years. AC