

Restrictions on regional airline fleet development and the lack of a larger RJ type, and the movement by airlines away from the smallest jetliners has opened a gap between 100 and 125 seats. The two biggest markets for aircraft to fill this are North America and Europe.

The North American & European requirement for 100-125 seat aircraft

There has been a broad range of 70-125-seat jet aircraft in two distinct groups for regional and major airlines to choose from over the past 35 years. More recently, the CRJ900, CRJ1000 and E-195 went into service between 2003 and 2010, following the Avro RJ family and Fokker 100. Large regional jets (RJs) filled the gap with the 113-seat 737-600, and the A318. Sales of the 737-700, 737 MAX 7, A319 and A319 new engine option (neo) have almost ceased. The fleet of 100-125-seat aircraft has declined by about 25% over the past 15 years. The fleets of smaller and larger size categories have grown over the period.

In the meantime, regional airlines have progressively moved from turboprops to increasing numbers of RJs, and steadily increased average aircraft size. Major airlines have also steadily increased aircraft size, away from the smallest jetliners. These two patterns have particularly been the case in North America and Europe.

This raises two questions: what has caused this development? and is there a large enough market to generate demand for 75 to -125-seat jets?

Market development

There are several explanations for these paths of fleet development. One is that major airlines consider the smallest 737 and A320 family members to have insufficiently competitive costs per available-seat mile (ASM). Another is that they have experienced high levels of traffic

growth, have saturated service frequencies, and have no new routes to open, although this latter explanation is unlikely.

The world's two largest markets for regional aircraft are North America and Europe. The North American market is dominated by the US, and major airlines are prevented from asking their affiliated regional carriers to operate RJs larger than 75 seats by their pilot union scope clause rules. European regional airlines are free to operate the larger types in the 85-100-seat category like the CRJ900, CRJ1000, E-190, E-195 and SSJ100. The global fleet of 75-100-seat aircraft has grown by a factor of 3.5 over the past 15 years to 1,850 units. The largest portion is operated in North America. This shows there is active demand for aircraft of this size.

The two main markets for 75-125-seat aircraft are North America and Europe.

These can be analysed on a macro and granular level. Capacity, route network, and airline fleet strategy developments can be illustrated by examining capacity data for these two markets over a 10-year period, from 2008 to 2018.

A macro analysis of the North American market over the past 10 years reveals an 11.9% increase in seat capacity, but an 8.1% decline in the number of services. This resulted in average aircraft size increasing by 20 seats from 92 in 2008 to 112 in 2018.

A macro analysis of the European market over the 10 years to 2018 saw a higher rate of growth than in North America. Total seat numbers grew by 36% to a similar number in North America. The number of flights increased by 11.4% over the same period. Average aircraft size in Europe has generally been larger than in



The North American regional sector is characterised by the scope clauses of the three major airlines limiting regional jet size to a maximum of 76 seats. The average size of all regional aircraft is 58 seats, leaving a wide gap between RJs and the smallest mainline jets.

NORTH AMERICAN & EUROPEAN NETWORK CAPACITY DATA 2008 & 2018

Year	North America 2008			North America 2018			Increase seat capacity	Increase average seats
Aircraft category	Total seats	Total flights	Average size	Total seats	Total flights	Average seats		
Turboprops	63,320,455	2,132,869	30	49,123,177	1,381,215	36	-22.4%	6
Regional jets	224,089,623	3,908,623	57	235,342,347	3,528,069	67	5.0%	10
Total regionals	287,410,078	6,041,852	48	284,465,524	4,909,284	58	-1.0%	10
Small narrowbodies	483,667,234	3,692,208	131	311,409,088	2,249,088	138	-35.6%	7
Medium & large narrowbodies	242,176,344	1,501,604	161	557,005,721	3,251,430	171	130.0%	10
Total narrowbodies	725,843,578	5,193,812	140	868,414,809	5,500,518	158	19.6%	18

Year	Europe 2008			Europe 2018			Increase seat capacity	Increase average seats
Aircraft category	Total seats	Total flights	Average size	Total seats	Total flights	Average seats		
Turboprops	60,173,629	1,170,463	52	60,757,863	968,207	63	1.0%	11
Regional jets	99,392,046	1,332,399	75	153,641,205	1,632,104	94	54.6%	20
Total regionals	159,565,675	2,502,862	64	214,399,068	2,600,311	83	34.4%	19
Small narrowbodies	165,304,714	1,269,084	130	160,699,521	1,146,191	140	-2.8%	10
Medium & large narrowbodies	566,627,722	3,497,279	162	818,101,502	4,520,936	181	44.4%	19
Total narrowbodies	731,932,436	4,766,363	154	978,801,023	5,667,127	173	33.7%	19

North America, and grew by 27 seats from 122 in 2008 to 149 in 2018.

Analysis also shows how the total capacity carried by each group of aircraft sizes has changed, and what portion of the total capacity in the market it represents.

This latter analysis shows, for example, how the number of total seats and flights provided by each type has changed over a decade. The overall clear pattern in both of these major markets is that major airlines are operating with smaller fleets of A318s, A319s, 737-300s, 737-500s, 737-600s and 737-700s. In turn, the number of larger A320, A321, 737-800 and 737-900 in operation has increased.

The same analysis is applied to regional aircraft. The decline in turboprops in both markets is apparent, while average aircraft size has increased over the same period. Meanwhile, there has also been a transition away from smaller RJs to larger types.

North American market

The first change in the North American market has been consolidation among major carriers, resulting in the seven largest airlines being compressed into three.

This started in 2005 with the merger of America West and USAirways. The absorption of USAirways by American Airlines was complete in 2015. Continental was absorbed into United in 2010, while the merger between Delta and Northwest was completed by the end of 2009. This has resulted in consolidation of airline capacity in the domestic US market. This

has had the effect of increasing passenger yields, and so airline profits.

The big three carriers operate as a combination of mainline operations and regional affiliates that provide feeder services. The regional carriers account for a large portion of total capacity provided by the three majors. The majors operate mainline jets; the smallest types operated are the A319 and 737-700.

Regional affiliates, operating as American Eagle, Delta Connection and United Express, operate a fleet of RJs with up to 76 seats.

Other large operators in the US are Southwest and jetBlue. Southwest only operates 737s, while jetBlue operates a mix of A320s, A321s and E-190 RJs, all within a single airline operation.

Frontier contributes to a significant portion of total US airline capacity. It operates with A320 family aircraft, and no longer has regional affiliate carriers. Alaska Airlines is the other major airline in the US. It has a fleet of 737 family and A320 family aircraft, having acquired Virgin America. Its regional subsidiary Horizon Air operates Q400s and E-175s. Alaska Airlines does not have a scope clause agreement with Horizon Air, so the former has more flexibility in its fleet plans than American Eagle, Delta Connection and United Express.

The two Canadian airlines providing the largest portion of intra-North American capacity are Air Canada and WestJet. Both operate with associated regional carriers: WestJet Encore operates

the Q400, and WestJet Link Saab 340s.

Air Canada's short-haul fleet is a mix of A320 family types and the 737 MAX, which was introduced in 2018 just before its grounding in early 2019. Air Canada's A319s are configured with 120 seats, and its next smallest type is a fleet of 15 E-190s with 97 seats. The airline has 45 A220-300s on order in a 145-seat layout.

Air Canada has two main regional subsidiaries: Air Canada Express and Air Canada Jazz. They operate the Dash 8-100 and -300, the Q400, CRJ-200, CRJ-900, and the E-175.

US regionals

The US regional airlines affiliated with the big three major carriers operate a mix of 45-50-seat RJs; and larger 70-76-seat RJs that are a mix of CRJ200s and E-175s.

The three major airlines all have scope clause agreements that allow their regional feeder counterparts to operate fleets of relatively high numbers of ERJ-140s, ERJ-145s, and CRJ200s in 44- and 50-seat configurations. While Delta's and United's scope clauses limit aircraft numbers, the upper limits are relatively high at 348 for Delta Connection and 350 for United Express. American Eagle has no limit, but operates 205 of these aircraft.

The three main US regionals cannot operate aircraft with more than 76 seats, and have more constraints on the number of larger RJs they operate than on smaller types. American Eagle is permitted to operate a number equal to 40% of the



mainline jet fleet, and has 410 aircraft. Delta Connection has scope clause limits of 102 70-seat aircraft, and 153 76-seat aircraft. It operates fleets of 99 and 223.

United Express can operate up to 255 aircraft with up to 75 seats, but actually operates 109. It has a scope clause limit of 153 76-seat aircraft, and operates the maximum number.

As described, there are no fleet planning limits on the number and types of RJs that can be operated by Horizon Air, WestJet Encore, WestJet Link, Air Canada Express and Air Canada Jazz. These airlines operate 225 34-78-seat turboprops and 135 large RJs, just 27 of which are now 50-seat CRJ200s. Most are larger E-175s and 76-seat CRJ900s.

In addition, jetBlue operates 60 E-190s within its mainline operation.

There are more than 700 large RJs in operation in North America.

Major carrier fleets

The fleets of US majors operated for intra-North American services are dominated by narrowbodies. The use of widebodies on major trunk routes has diminished, and high-frequency services with larger variants of the A320 and 737 families have become the norm.

The 757-200 dominated the US domestic fleet for many years. The numbers operated by all three US major airlines have declined as fleets have been phased out. The MD-80 was also operated in large numbers, with the fleets of American, Continental, Delta and Alaska Airlines at one time accounting for more than half the 1,100 MD-80s built. Delta also operated the MD-90. There are fewer than 100 MD-80s/-90s left in operation in the US.

As fleets have developed, the A319, A320 and A321 have been operated in increasing numbers. The 737-300 and -400 were operated in large numbers from the mid-1980s, together with the MD-80, 727-200 and 757-200. The 737 Classics have since migrated to the 737NG family, in particular the 737-800 and -900. 737 MAX 8 and MAX 9 deliveries started in 2018.

In the case of A320 and 737 families, the smallest members account for the smallest portions of the combined fleets of the major airlines. The operational A319s account for just 24% of the A320 family fleet, while the A320 and A321 fleets account for 40% and 36% of the active aircraft. Moreover, the A321 accounts for 71% of the 547 A320 family orders for these airlines, with the balance for the A320. The A319 only has 24 firm orders outstanding.

Similarly, the 737-800 and MAX 8 have 924 aircraft among North American major airline fleets: 50% of the 1,861 aircraft. The 737-900 and MAX 9 have another 304 aircraft: 16% of the fleet. The 737-700 accounts for a large portion, with Southwest operating more than 500. It is developing with larger aircraft, with 246 MAX 8s on order, and just 30 of the smaller MAX 7s.

Outstanding orders held by these airlines for the 737 family are concentrated with the larger variants. These carriers hold 357 orders for the MAX 8, and 112 for the MAX 10. Perhaps curiously, there are fewer firm orders for the MAX 9 at 64.

These fleet and order numbers clearly illustrate the shift to larger narrowbody variants in North America. This is also shown by the A321 accounting for 36% of the active A320 family fleet, and which accounts for 72% of the firm orders.

The A321 is now the largest available narrowbody. Major in North America airlines have heavily reduced their use of the smallest narrowbodies, and average narrowbody size has increased by 19 seats in 10 years.

With the retirement of most 757-200s, American Airlines has increased its active A321 fleet to 228 units, and has a further 111 on order. Delta has similarly retired most of its 757-200s; it has 95 A321s in service, and 132 more on order.

Capacity distribution

This shift by the major airlines to larger A320 and 737 family variants, and the adoption where possible of larger RJ types by regionals, is reflected by the development of the intra-North American network capacity over the past 10 years. The portion of annual seat capacity and number of flights has increased for larger types, and reduced for smaller aircraft.

Over 10 years seat numbers have increased by a moderate 11.9%, as described. The portion of total seats provided by widebodies is small, and changed little since 2008.

There have been several main changes in the portions of capacity provided by regional and narrowbody aircraft types over the 10 years to 2018.

The first is that, perhaps unsurprisingly, the portion of total seats in the intra-North American network provided by regional aircraft has dropped by 3.5 percentage points. This is mainly explained by the limitations of US airline scope clauses. While the total market has grown by 135 million seats, of the 11.9% increase since 2008, 3 million fewer seats were provided by regional aircraft in 2018 than in 2008.

The capacity provided by regional aircraft changed in several ways over the 10 years to 2018. The first main change is the decline in capacity provided by all classes of turboprops. This has declined from 63 million to 49 million; itself a drop of 22% (see table, page 14). Turboprop seat capacity was just 4.2% of the total in 2018.

This large decline is a combination of growth in the use of large turboprops, and a decline of smaller types. Over the 10 years to 2018, the number of network seats provided by aircraft with up to 19 seats halved, while the number provided by 35-45-seat turboprops fell by 88%. The capacity provided by 45-50-seat turboprops also fell by 16%. Meanwhile, the utilisation of the large ATR-72 and Q400 turboprops approximately doubled over the same period.

The 40-50-seat turboprops have declined from their peak use in the 1980s and 1990s, and fleets are being phased out



by most remaining operators. This follows the earlier retirement of most 30-35-seat turboprops.

The main Q400 operators in North America are Horizon Air, WestJet Encore, Air Canada Jazz and Porter Airlines. These carriers are attracted by the Q400's ability to generate lower costs per ASM over its smaller predecessor, the Dash 8-300, and a faster cruise speed. There are no large fleets of ATR72s operated in North America.

The second main change in North American systemwide network capacity is the 5% increase in annual seats provided by RJs (see table, page 14), compared a total market increase of 12%. The small increase by RJs reflects the limitations of regional fleet development by major airline scope clauses. While annual seat numbers grew, the number of flights declined by 10%. The use of 50-seat RJs over the network has halved to about 63 million seats, while the capacity provided by 65-76-seat aircraft has doubled to 103 million. The expansion of this category is now partly limited by the scope clauses of the three big US major airlines. There are a few other airlines that could expand their fleets. Current operators include Air Canada Express with CRJ900s and E-175s.

In addition, annual network capacity provided by the largest RJs with 80-105 seats has approximately doubled, thanks to those airlines that are not limited by scope clauses, including jetBlue and Air Canada, which operate a total of 75 E-190s. There are more than 700 CRJ900, CRJ1000, E-190 and E-195 aircraft in operation in North America.

The limitations placed on the US majors' regional affiliates prevent these airlines from exploiting the potential to serve a larger number of routes and

frequencies. This is in the form of existing routes operated by these regionals, routes operated by the mainline jets with larger aircraft types, and unserved routes.

The third main change to the North American market is the reduced utilisation of the smallest A320 and 737 variants. Annual seats provided by the A319 have declined by about 9% since 2008, and those provided by smaller 737 variants reduced by 33%. The operation of 717s, DC-9s and MD-80s has also dropped. There is a wide range of seat capacities for the A319 and smaller 737 variants.

This shift away from these smaller types has seen their portion of the market total decline from 46.3% to 26.4% over the 10-year period, and a drop of 172 million seats to 311 million in 2018 (see table, page 14). The data also shows a move to higher seating densities; average seat numbers in this category has increased by seven.

The fourth main change is a large increase in the portion of capacity provided by medium- and large-sized narrowbodies.

The total annual systemwide seats provided by the A320 and 737-800 and all larger narrowbodies has increased from 242 million seats in 2008 to 557 million seats in 2018 (see table, page 14); an increase of 130%. The number of operations with these aircraft has also increased, but at a lower rate. The average aircraft size in this group of aircraft has actually increased by 10 seats to 171 (see table, page 14), despite the use of the 757-200, the largest narrowbody in the network, falling by two-thirds.

The increase in average aircraft size is explained by the increased portion of capacity provided by the combined A321 and 757-200 fleet. It is also explained,

The limitations of pilot union scope clauses means that major airlines will need to fill the gap between the largest regional jets and medium-sized narrowbodies. Delta Airlines will operate both the A220-100 and A220-300.

however, by an increased use of the 737-900, and higher seat configurations for the other types, such as the A320 and 737-800. These changes have been mainly driven by the need for airlines to seek lower costs per ASM.

Overall, the changes to the macro capacity data for narrowbody operations in North America indicate the need for major airlines to increase capacity to absorb growth because of the limitations of scope clauses. The macro data also shows the shift by major airlines to larger types, and the use of cabin densification to increase capacity of existing aircraft; both to reduce in unit cost per ASM.

There is also the ageing 757-200, which ceased production in 2005, and for which there is no equal-sized replacement.

All these factors combine to indicate a migration by major airlines away from the A319 and 737-700. This is illustrated by the small number of orders received for the A319neo and 737 MAX 7, and how they contrast to the A320neo and 737 MAX 8.

North American market gap

This development is likely to continue, leaving few A319s and 737-700s in operation in North America in another 10 years. These aircraft are configured with between 118 and 156 seats by airlines in this market. The A320, with 146-186 seats, is the next largest type. The current 76-seat limit of the US major regional airline scope clause thus leaves a seat gap of 75 seats, between 76 and about 125 seats, but up to 135 in this market. This gap can, however, be partially filled with larger RJs by airlines that are not affected by scope clauses.

The average size of the largest 80-105-seat RJs across the network in 2018 was 84 seats. The next largest group of aircraft was the smallest narrowbody airliners; the A318, 717, 737-500/-600, and 737-300; with an average size of 115 seats. These, however, only account for a small percentage of capacity, and are being phased out. There are fewer than 100 of these types in operation in North America.

The A319s across the network provide a similar capacity to the large RJs. The A319s have an average seat capacity of 132 across the network. This group of aircraft has declined in numbers since 2008. There are about 390 A319s in operation in North America. Above this,

The E-195 has been one of the largest regional jets available to airlines. These are operated with a typical capacity of 112 seats.

larger 737 variants have an average size of 143 seats. The market gap is therefore 84-132 seats, and arguably up to 140 seats.

The development of North American airlines' fleet capacity over the past 10 years has affected the number of routes that can be served with the appropriate aircraft types. The gap between large RJs and the smallest economic jetliner types has left a large number of potential routes unserved. Analysis of the top 100 airports in North America, ranked according to passenger numbers, reveals that only 33% of possible routes to the other 99 biggest airports actually have airline services. There are therefore a large number of unserved city- and airport-pairs in North America. The two main reasons for this are a lack of traffic volume to justify jetliner types, and the route being too long for the RJs that are available on the market.

Analysis of 35 major US and Canadian airports reveals the difference between major hubs and other airports. Of the 35, 14 are major hubs: Atlanta, Chicago O'Hare, Dallas Fort Worth, Denver, Houston, Minneapolis St. Paul, New York Newark, Seattle and Toronto Pearson. These each have services to 105-200 destinations.

The 19 smaller airports have fewer direct connections. These smaller airports include Boston, Baltimore, Calgary, Cincinnati, Dallas Love Field, Fort Lauderdale, Hartford, Memphis, Miami International, Milwaukee, Montreal, Portland Oregon, San Antonio and Vancouver. Each of these serves 33-94 destinations in North America.

There are many other smaller airports with an even smaller number of routes to other North American destinations.

There are about 300 unserved markets in North America with average route lengths of 1,900nm that would generate enough traffic to support a service with a minimum of two daily frequencies.

European market

The intra-European market has seen similar changes to North America. Europe is a higher cost environment than North America. On a dollar-for-dollar basis, Europe has higher labour and user charges. This has meant that regional carriers in particular have on average operated larger types than in North America. For example, few European regionals operated 19-35-seat jets in the 1980s and 1990s, while they



were operated in large numbers by regional feeders in the US. Another point is that 40-50-seat RJs were operated by US airline regional feeders in large numbers, while few European regional carriers did so.

Another notable feature of Europe is that its relatively high-cost operating environment means that there is a definite market for RJs. RJs will always have a unit cost per ASM advantage, and will be the preferred choice on short routes or those with low demand and passenger yields.

The pattern of European airline capacity development over the past 10 years has some parallels with North America, but there are also differences.

Turboprops

The decline in capacity provided by turboprops up to 19 seats was 17.6% over the 10 years to 2018. The rate was 52% in North America. The decline in larger turboprops to 50 seats has been similar to North America at about 75%. These smaller types have been replaced with the larger ATR72 and Q400, with a 75% increase in capacity provided since 2008.

Large turboprops have replaced smaller types on a one-for-one basis. The capacity provided by all turboprops in the total market remains unchanged from 2008 to 2018, with about 60 million seats being provided in both years (see table, page 14). Large turboprops accounted for 82% of seat capacity in 2018.

Regional jets

The capacity provided by RJs has increased, with a rise in annual seat numbers of 55% to 153 million in 2018. Average RJ size increased by 20 seats over the same period (see table, page 14). As

with turboprops, there has been a decline in smaller types of RJ and a substitution with larger aircraft. The use of the smallest RJs up to 37 seats has declined from an initially small base of 1.24 million seats by 66% to 417,000 seats in 2018. The use of 45-50-seat RJs was small in 2008, at just one-sixth the level in the North American market, at 21.7 million seats. Capacity provided by these aircraft has fallen by nearly 80%.

Meanwhile, the use of 67-80-seat aircraft has grown by about 27% over the 10-year period. This includes older types such as the smaller variants of the Avro RJ and the Fokker 70; as well as modern types such as the E-170 and E-175. The main European E-170 and E-175 operators include Alitalia, KLM Cityhopper, LOT Polish, and French regional carrier HOP!

The sector to experience the largest growth, and be responsible for most of the growth in regional operations, is the largest 85-100-seat sector. This includes the E-190 and E-195, CRJ900 and CRJ1000. There are also the first few E190-E2s in operation. There are about 350 of these aircraft in operation in Europe.

The seat capacity provided by this group of aircraft has increased by 115%, more than doubling from 58 million in 2008 to 125 million in 2018. The number of flights operated grew at a similar level.

When all regional operations are taken into account, there was a 35% increase in seats from 2008 to 2018, but a smaller increase of just 4% in the number of flights. This saw a large increase in average aircraft size of 19 seats over the period to an overall average of 83 seats. This compares to an increase of 10 seats in North America. The larger increase in Europe is perhaps unsurprising, given the high cost environment.



Small narrowbodies

The third most noticeable issue in the European market has been the drop in the use of small narrowbodies. This has been small at about 2.8% fewer seats in 2018 compared to 2008. It contrasts, however, to a 29% rise in North America.

This includes the A319, 737-300, 737-500 and 737-600. The group also includes the A220-100, which was operated in small numbers by Swiss in 2018. The slight drop in seat numbers and services is a clear indication of a move to larger aircraft types. Despite this, aircraft in this category had average seat numbers of 10 more seats than in 2008 (see table, page 14).

Medium & large narrowbodies

Medium- and larger-size narrowbodies have seen an overall 44% increase in seats and 29% increase in number of flights. Average seat count in the group therefore rose by 19 (see table, page 14). Aircraft in this category include the A220-300, the A320, A321, medium- and large-sized 737 variants, the Tu-204 and the 757-200/-300.

This group of aircraft accounts for the second largest increase in capacity of 251 million seats, a 44% rise. The A320 and A220-300 account for the second largest group of seats across the network in 2018, with 311 million seats across the network, compared to 140 million seats in 2008.

The medium- and larger-sized 737 variants comprise the largest group, with 373 million seats systemwide in 2018, a 25% increase over the 10 years from 2008.

The capacity provided by the A321 almost doubled, while that provided by the 757-200 fell by 80% to just 5 million seats and 19,300 operations per year.

The move to larger types is illustrated

by narrowbodies, with average seat capacity increasing by 10 to 171 in 2018 over the whole network. This is despite the retirement of most 757-200s. A main factor has been a large number of 737-400s being replaced with larger aircraft, while airlines have also adopted densification strategies.

Europe market gap

While regional and narrowbody aircraft have both increased average aircraft size, as with the North American market, there is a clear gap between the largest regional types and the smallest narrowbodies. The largest RJs have an average seat capacity of 102, while the smallest narrowbodies have an average size of 140. The changing mix of the small narrowbody fleet and its European operation has to be taken into account. A large number of the smallest 737 variants and A319s have been removed from European airline fleets.

The problem is exacerbated by the extended period for which the large RJs have not been available. The largest variant of the Avro RJ, the RJ100, had up to 112 seats. Similarly, the Fokker 100 could provide more than 100 seats in some configurations. The only aircraft with 115-125 seats have been small jetliner variants. Their combination of old technology and high weights makes them expensive to operate.

As with North America, there are a large number of city- and airport-pairs that are not served. Europe has more than 30 countries, and many have a large number of airports. Moreover, there are several capitals with multiple airports. London has scheduled services from six airports, Southend being the smallest.

Swiss has selected the A220-100 and -300 to replace the Avro RJ and A319, and hence use a single type to replace large RJs and small jetliners.

There are about 200 busy airports across the continent. The steady growth of traffic over the past 30 years has transformed a large number of secondary and small airports into minor hubs.

The overall effect is that there are a larger number of airports in Europe that serve more than 100 destinations in Europe than in North America; a large number that serve more than 150 routes, and a few serving close to 200 destinations.

These include London Heathrow and Gatwick, Manchester, and Birmingham in the UK, and capital cities across Europe. France, Germany, Italy and Spain all have secondary cities which serve more than 100 destinations.

There are also large numbers of medium-sized and small airports that serve fewer than 100 destinations. These all have the potential to expand their networks.

Macro analysis of the European route network reveals that only 56% of possible routes to the other 99 top airports are actually served. There are more than 200 large and medium-sized airports, so there is large potential for new routes. At least 250 new routes that average 1,900nm could be opened with a minimum daily frequency of two services. These routes are too long to be operated by most RJs.

As with North America, a main factor is the lack of the right sized aircraft with the commensurate range capability.

Other markets

While North America and Europe have traditionally been the largest markets for 100-125-seat aircraft, the issue remains of unserved routes and markets in other parts of the world. These are all affected by the upper limit of 105 seats for the large RJs, and the 125-seat capacity at the bottom end of the small mainline jet families; and the migration by airlines to larger variants.

These markets include Russia and the Commonwealth of Independent States (CIS), the Middle East, Africa, Latin America and the Asia Pacific. These all require aircraft with relatively long-range performance, the right seat capacity, and competitive cost per ASM performance.

As with North America and Europe, analysis of the top 50 airports in these regions reveals a relatively low percentage of routes being operated from each one to the other 49. This is as low as 12% in the Middle East and 35% in the Asia Pacific.

The Asia Pacific has large widebodies

There has been a reduction in the use of the smallest A320 and 737 family jetliners in most regions of the world. This has created a gap in the 100-125 seat range. Europe is one particular market.

operating on major hub-to-hub routes, but there are 400 potential new routes not being operated with an average distance of 1,700nm that could be opened with 100-150-seat aircraft.

A similar number of new routes has been identified on the Indian sub-continent that would require aircraft in the 100-150-seat category. These are also long-range, with an average sector length of 1,800nm.

The Middle East has 315 new potential routes with the same characteristics.

Fleet planning options

There are two main ways to fill the seat gap between large RJs and small mainline jets, thereby allowing more routes to be served optimally, and new ones to be opened. The first is a renegotiation of US airline scope clauses that increases the seat number limit and fleet size that regional affiliates are permitted to operate. Even if a renegotiation of scope clauses by all three US majors achieved this, the increase is unlikely to be of sufficient size to fill the market gap.

The second is the adoption of new aircraft types by the airlines operating as mainline carriers. These would need to be in the 100-125-seat category, but with an operating cost performance that makes them more competitive than the A319 and 737-700. This would follow jetBlue's and Air Canada's operation of the E-190. These aircraft are configured with 97-100 seats. No E-195s are operated in the US.

The global fleet of aircraft in the 100-125 seat category has declined by 25% over the past 15 years. The types that could fill this market gap are a proposed stretch development of the Sukhoi SSJ 100, the Embraer E195-E2, and the A220.

The SSJ100 has a standard capacity of 87 to 108 seats, depending on single- or dual-class cabin layout. The proposed stretches would seat 115-120 and 130-140.

There is also the E195-E2, with a standard seat capacity of 120-132, with 120 in two classes and 130 for the single class variant. The E195-E2 has a range of 2,600nm, which is 150-300nm shorter for the original E-190 and -195.

Neither of these two completely fills the gap in the market, and the A220 has the -100 and -300 two variants with higher dual-class seat capacities of 110-135 and 130-145. The two variants have a range with these loads of up to 3,400nm and 3,350nm. This places the A220 in the best



position to fill the market gaps described. The A220 variants will fall between the largest Embraer E Jets and the A320 and 737-800/MAX 8. This is because the A220-300 will be configured with a seat capacity between the 737-300/-700, MAX 7 and A319; and the A320/737-800. There are also no other types available in this size category.

The A220-100 has only been ordered by one US carrier, Delta. It has selected both the -100 and -300. The A220-100 is configured with 109 seats in a three-class arrangement. The -300 series will have 130 seats, although cabin layout is not yet decided. Delta has ordered 45 and 50 of these aircraft, with both types operated in the mainline fleet. The A220-100 will partly replace the airline's 717 fleet and the CRJ900s operated by its regional feeders.

jetBlue has ordered 70 of the -300 series, which will have a two-class cabin configuration of 140 seats. These have been ordered to replace its E-190s.

The A220-300 will allow the airline to operate longer-range domestic US routes that exceeded the E-190's performance, and the A220's wider cabin will provide commensurate improvements in cabin comfort. The A220-300 should also bring benefits of lower fuel burn and airframe-associated maintenance costs.

Air Canada has 45 of the A220-300 series on order; these will have a similar seat count to jetBlue of 137 in two classes. The airline plans to use the A220-300s to replace its E-190 fleet, and so will be able to operate a larger route network. The airline has 16 A319s in service; these are configured with 17 fewer seats than its A220-300.

There are several examples of the A220 providing airlines with fleet-planning flexibility and the opportunity to open new

routes, and consolidate fleet types. One example is Egyptair. It will use the A220-300 as a larger type to replace its E-170 fleet. The E Jets were used primarily for domestic services, and the A220 will allow the airline to expand its network across the Mediterranean to cities that will generate relatively low traffic volumes.

Swiss has ordered the A220-100 and -300 to replace its combined Avro RJ and A310 fleets. The A220-100 has allowed Swiss to operate with higher frequencies from Geneva on routes where the A319 competes with easyJet.

Similarly, Air Baltic has replaced several 737 variants with the A220-300 in a 145-seat configuration. Not only has this simplified fleet management, but it has also allowed it to open long thin routes. An example is its service from Riga to Dubai.

Meanwhile, the E-195, E190-E2 and E195-E2 will be the main choice for regional carriers that do not require the A220's long-range performance. The E-195 has a maximum take-off weight (MTOW) of 14,000lbs lighter than the A220-100, so may suit the needs of regional airlines. The A220-100 also has a weight advantage over its closest alternatives, the 737-600, 737-700, and A319. Similarly, the A220-300 and 737-700 have a close MTOW, but the A220-300 has a seat capacity advantage.

The A220 offers major airlines the potential to fill the seat gap between the A320 and 737 variants and large RJs by extending seat capacities down to 115 seats; rather than increasing a large RJ in size by stretching, and extending its seat capacity up from 105-115 seats. **AC**

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