

The variety of 70-110 seat jets are at various stages of development, while markets for them appear to be evolving. Each market has its cost structure characteristics and some have degrees of restriction on which aircraft they can operate. Adrian Hamilton-Manns analyses the performance of the 10 aircraft in each market.

Finding roles for 70-110 seat jets

The Regional Jet market has experienced considerable growth in the past 6 years, with many operators replacing both turboprop and smaller jetliners with regional jets (RJs). Routes where smaller RJs were used to replace turboprops are reaching maturity, thereby accelerating demand for larger aircraft. This demand will accelerate further once these aircraft become fully available.

Development of 70-110 seat RJs has blurred the distinction between RJs and mainline jets. The ERJ-170/-175, ERJ-190/-195, CRJ-700 and CRJ-900 are placing pressure on the 717 and A318. The 728Jet and 928Jet will also take some of this market if they are developed. The aircraft and their seat capacities and manufacturer's list prices are summarised (see table, this page).

Larger RJs enjoy a cost margin over the smallest jetliners in some scenarios, and these aircraft compete in some markets.

Large RJs and small mainline jets have their pros and cons, depending on which routes and markets will support and have better cost structures for either group of aircraft.

Potential markets

The number of 70-110 seat aircraft in operation shows that a ready market exists. Up to 1,732 units were produced by McDonnell Douglas (976 DC-9s), BAE (307 RJ & 146s) and Fokker (449 F28s, Fokker 70s and Fokker 100s). Analysis by Bombardier suggests that the market for 70-110 seat aircraft will require 2,000 units over the next 20 years. This may prove conservative when the 737-200 fleet is included.

There are four main markets for 70-105 seat aircraft. These are: i) growth of route networks operated by 30-50 seat RJs; ii) direct replacement of the 737-200, DC-9 and other small older generation jetliners; iii) replacement of larger narrowbodies with smaller types due to reduced traffic or increased route frequency and; iv) organic market growth by airlines which currently operate large RJs, such as BAE 146s/RJs and Fokker 70/100s.

Average stage length is in the range of 300-500nm. All aircraft will operate a high-frequency, secondary route structure and the majority will feed a major hub. Development of hub bypass networks has

failed, mainly because incumbent airlines have been protecting their hubs.

RJs have an advantage where weight-related and flight crew costs are low and airline unions allow large RJs to operate. The dynamics of these criteria in each market determine the choice between large RJs and mainline jets. They also affect the potential for market development.

30-50 seat RJ growth

A 70-110 seat market will grow from the existing 30-50 seat market. These small RJs currently account for the bulk of the world's RJ fleet. They account for 74% of regional US available seat-miles (ASMs), 64% of European ASMs, 26% of intra-Asia ASMs, and 36% of Australasian ASMs.

The economics of adding 30-50 seat RJ frequencies are weak compared to increasing aircraft size. Straightforward replacement or supplementation of large numbers of Do328 Jets, ERJ-135/140/145s and CRJ-200s with 50-70 seat jets by US regional carriers would seem logical, and provide the largest potential market for large RJs. It is only

LARGE RJ AND SMALL MAINLINE JET SEAT CAPACITY & LIST PRICE DATA

Aircraft type	CRJ-700	ERJ-170	ERJ-175	728Jet	CRJ-900	ERJ-190	928Jet	ERJ-195	717	A319
Seats	66	70	78	80	84	98	100	110	115	115
List price \$ million	26.8	23.5	25.3	28.7	30.0	28.0	34.0	29.6	35.0	35.0
MTOW (lbs)	72,750	78,000	79,000	77,440	82,500	105,798	104,058	110,798	121,000	145,500



theoretical because of pilot scope clauses preventing use of these aircraft.

With the exception of Horizon Air, most US Major regional affiliates are limited in their development of 50+ seat regional jets.

The recent developments at US Airways (see USAirways cracks scope clause RJ seat limit, page 3), where USAirways' pilot union is likely to agree to a significant relaxation in its scope clause, may result in a rapid expansion of the large RJ market in the US. The new agreement would allow US Airways to operate up to 315 RJs of any size together with regional affiliates.

Scope clauses limit the number of RJs larger than 50 seats that most US carriers can operate. These limits have now all been reached.

USAirways' formidable achievement with its scope clause negotiation could set a precedent for all other US majors, and provide a boost to the large RJ market. Scope clauses have artificially boosted the 30-50 seat RJ market in the US by capping aircraft size. Pent-up demand for larger RJs would be released if scope clauses were relaxed.

Europe requires larger RJs to overcome higher costs. Routes not operated can be developed by these new aircraft, and those operated by the CRJ-200 or EMB-145 can convert to larger aircraft. Thus although the 30-50 seat RJ market is smaller in Europe than in the US, larger RJs are a natural progression for European carriers to aid them in reaching a more competitive unit cost per ASM.

Jet replacement

Replacement options for the DC-9, 737-200, Fokker 100 and BAE 146/Avro RJ fleets have already been examined (see How & when can the DC-9 & 737-200 be replaced? Aircraft Commerce, January/February 1999, page 16). This group of older aircraft also includes the F.28 and Fokker 70 and 100, which are operated by major airlines in the US and smaller or second-tier independent carriers elsewhere. Examples are British European, TAM and National Jet.

Many DC-9s have another 5,000 flight cycles before the next package of ageing aircraft updates, and are fully depreciated. Fuel efficiency and maintenance hour reductions of new aircraft are not enough to replace older ones before necessary. Northwest stated that its DC-9s might be retained for another 10 years.

Other DC-9s have already been retired, as in the case of USAirways, and replacement orders made. There are also large numbers of 737-200s, BAE 146s/Avro RJs and Fokker F.28s/70s/100s. An economic case could be made for their replacement.

Most airlines operating these aircraft have not been restricted by scope clauses or other pilot union issues, and so are free to select either large RJs or smaller mainline jets.

Actual choice depends on the market where they operate and its inherent cost structure. Large RJs have advantages associated with low weight.

The US is generally characterised by

Small mainline jets reduce the risk of encountering low traffic volumes, which are now more common with increased liberalisation and competition. Analysis shows that despite their high weight and cash operating costs they also have unit costs lower than most regional jets.

having low weight-related tariffs and high pilot salary scales in comparison to other parts of the world. Large RJs cannot take advantage of their low weight in the US, but would be disadvantaged by high pilot salaries when operated by major airlines.

A reverse situation might be expected in Europe where pilot salaries are low and weight-related tariffs are higher than in the US.

The situation differs in Australasia, where both weight-related charges and pilot salary scales are low.

Market growth options

The 70-110 seat jets could be used on developing and emerging 50-100 seat markets.

Operators are not influenced by consumer reaction when selecting either large RJs or small mainline jets. The benefits of increasing size to large RJs instead of mainline jets would be attractive to most operators. It would allow them to maintain more routes at a profitable load factor with lower trip costs. Similarly, small mainline jets provide the first step into the jetliner class from regional jets without excessive increase in capacity and trip cost.

The RJ growth market is largest in Europe. Examples are provided by the likes of British European, Swiss/Crossair, Air Botnia, KLM Cityhopper, British Airways/Cityflyer Express, Iberia/Air Nostrum, Lufthansa/Lufthansa Cityline and Air France and its regional affiliates. Many of these carriers are also unrestricted by scope clauses, and are sensitive to aircraft weight costs.

The growth market is virtually non-existent in the US, where scope clauses have prevented a 50-100 seat market from emerging. This gap also means that there is no natural transition from large RJ to small jetliner. An exception of a potential RJ growth market is Horizon Air, which could operate F.28s.

If the recent agreement by USAirways allows it to fill the 50-60 seat gap between itself and its regional carriers with large RJs, then growth will eventually lead to the transition to small jetliners. This will take several years to achieve, however.

If the achievement of USAirways is repeated by other US majors, it could provide another growth market for 70-110 seat jets.



The Asia Pacific, South America, and Australasia all have potential for RJ development. TAM has already placed an order for the ERJ-190/-195. With the collapse of Ansett, the Australian industry has consolidated around Qantas and Virgin Blue. Beneath these two operators, which battle on the heavily travelled trunk routes, are several other operators. Kendall, a former Ansett subsidiary, continues to operate as an independent carrier. There are also regional operators that feed Qantas, and the former Ansett subsidiaries Sky West, Flight West and Hazleton. These airlines all have potential for larger aircraft. There is also a high level of suppressed demand, because of low regional service by Qantas' competitors, which could be served by large RJs and small jetliners. Meanwhile, Air New Zealand has routes that could be served by large RJs.

Reduced aircraft size

The arrival of the 717, A318 and large RJs has made it possible for airlines to reduce capacity to better match demand. Liberalisation, deregulation and more routes have seen seat requirements fall. The progression of low-cost or no-frills carriers has also seen the traffic volumes of incumbent carriers eroded. Air Canada and British Airways are prime examples in recent years, but others could experience similar pressures.

Routes that suffer from over-capacity (for example, LHR-AMS, PHL-ORD, and CDG-FRA), or mature routes that have marginal return on a 160-seat aircraft (for example, LHR-NCE, and BNE-CNS), are potential routes for the 70-105 seat market. An airline struggling at 55% load factor on an A320 route

would realise an increase of 22 load factor percentage points if it used an A318. There would also be the benefits of increased revenue management opportunities due to the greater demand levels, and yield mix would improve.

AirTran, competing with Delta at Atlanta, is an example of reduced aircraft size. Although AirTran did not replace existing aircraft, it shows how a smaller aircraft, the 717, can be used to compete with a larger rival.

AirTran needs low capacity and type commonality to avoid risk and must produce a lower cost per ASM to compete with Delta. The 717 reduces AirTran's risk on start-up routes. Boeing and Airbus will seek to exploit this strategy type by offering major carriers this flexibility option. These aircraft will remove the need for sub-fleeting to RJ level, and the additional complexity of crewing, fleet management and maintenance for two or three aircraft types.

Airbus markets its aircraft on the family concept of aircraft commonality, which is one appeal of the A318. Embraer can apply the same technique when marketing the five-seat smaller ERJ-195.

In the US, where 51% of domestic ASMs are generated by 140-160 seat aircraft (including A320, 727-200, 737-800 and MD-80), 32% of all the routes they serve have an average load factor below 60%. In Europe 27% of routes are operated by aircraft of the same capacity and have a load factor of less than 60%.

The replacement of mainline jets with smaller RJs is an economic argument that has some weight. BMI British Midland placed some routes with their regional subsidiary operating Fokker 100s.

Only a few of the large regional jets are available to airlines, but changes in the market could see demand for these aircraft flourishing. They provide transition from 50-seat regional jets to the smallest airliners, and the largest regional jets are more efficient than the smallest mainline jets.

Aircraft selection

There are four markets the large RJs and smallest mainline jets can serve, which leads to aircraft being considered under several airline cost structures.

The first market is dominated by the US, but is currently restricted by scope clauses. One carrier now considering large RJs freely is USAirways for its regional affiliates. The economics of large RJs therefore must be considered under the cost structure of a US regional affiliate airline.

Europe is the other main market with 30-50 seat jets, and so must also consider the large RJs or even small mainline jets, under the cost structures of secondary and regional European airlines.

The second market of jet replacement applies to major US airlines, and major and secondary European and also Australian airlines. The fourth market of aircraft size reduction applies to the same type of airlines. The aircraft are then analysed for these two markets with the cost structures of these type of airlines.

The third area of market growth does not apply to the US, and is only relevant to secondary airlines and regional airlines in Europe and Australasia.

The cents per ASM unit cost performance of aircraft are therefore analysed for the four airline cost structures of US regionals, US majors, European secondary airlines and Australasian airlines.

Economic assessment

Considering the different markets and their inherent cost structures, which aircraft would have the lowest cost per ASM? This could vary in these four markets due to differences in weight-related charges, pilot salaries, but also possible purchase costs, resulting finance charges and aircraft utilisation.

The cost analysis includes fuel, maintenance, finance charges and insurance, landing and navigation fees, crew and spares.

Purchase costs and resulting finance charges are subject to many variables. An assumed discount from the list price of 25% is achievable, while some manufacturers may even go further to secure orders. The calculated purchase prices, after discounts, and cost per seat were used:

These current fuel prices are high compared to historic levels.

Cost performance

The ERJ-195 has the lowest unit cost in all four scenarios. This is a reflection of its light RJ characteristics, 110 seat capacity and low acquisition cost.

The charts (see pages 22 & 23) show unit costs of the 10 aircraft in ascending order of seat size, and the major variables which affect an RJ's unit cost performance.

Spares and insurance are negligible, while landing and navigation charges are high in Europe and Australasia (see charts, page 23).

US Major

The main cost driver for a US Major is crew salaries (see first chart, page 22). This benefits the larger aircraft, which can offset the higher costs, over the smaller RJs, with more seats.

The CRJ-700, the smallest aircraft, has a unit ASM cost of 9.4 cents. The next largest, the ERJ-170, has a unit cost of 8.7, while the ERJ-175 produced 8.1. The largest 70-80 seat aircraft, the 728Jet has a unit performance of 8.5 cents per ASM. The performance of the three largest aircraft decrease with increasing aircraft size, except for the 728Jet (see first chart, this page). This has a unit cost of 0.40 cents higher than the ERJ-175, which is smaller by two seats. The 728jet is both heavier and has a higher list price than the ERJ-175.

The CRJ-900 has a unit cost performance of 8.0 cents; similar to the smaller aircraft. The 928Jet generates a similarly high unit cost of 7.8 cents. These are high compared to the ERJ-190 and ERJ-195. The ERJ-190 has an advantage of 0.75 cents over the 928Jet, despite the 928Jet being two seats larger.

The ERJ-195 is the most efficient, with a unit cost of 6.76 cents. This compares with the 717 and A318, which are only five seats larger but have unit costs of 7.5 and 7.4 cents.

Despite the US majors having high pilot salaries, this analysis shows the ERJ-190 and ERJ-195 can offer unit costs acceptable to airlines, while other RJs have higher costs. The 928Jet may have a cost performance that is acceptable.

The small RJs clearly do not belong in the fleet of a mainline operator, since they are disadvantaged by the high pilot salary structures of major US carriers. These aircraft perform best when operated by an affiliate airline whose pilot cost structure is lower.

Also, the US Market is not weight-sensitive like the European one, so the RJs' advantage of low weight has less impact.

Aircraft	Calculated price \$ million	Price per seat \$ '000s
● CRJ-700	20.1	304
● 728Jet	21.6	269
● ERJ-170	17.6	252
● ERJ-175	19.0	244
● CRJ-900	22.5	268
● 928Jet	25.5	255
● ERJ-190	21.0	214
● ERJ-195	22.2	202
● 717	24.5	213
● A318	26.2	224

Assumptions are an average stage length of 512nm. This is the average sector length operated by aircraft with less than 130 seats in the US and Europe. Aircraft utilisation for the different regions expressed as flight hours (FH) and flight cycles (FC) was used as follows:

- Europe 2,400 FH/1,755 FC
- North America 2,600 FH/1,902 FC
- Australasia 2,700 FH/1,975 FC

All aircraft finance costs have been calculated assuming 100% debt financing at an interest rate of 7% over a 15-year term to a 10% debt balloon.

Flightcrew salaries are based on schedules in Europe and North America, with parity assumed for Australasia indexed to regional living standards.

Navigation and landing rates are based upon maximum take-off weight (MTOW) for Europe. North America and Australasia charges are calculated on landing weight.

Fuel burn per aircraft has been analysed previously by Aircraft Commerce. The CRJ-900 will consume 725 gallons to complete the 512nm flight length. The other aircraft will consume the following additional fuel for the same mission: CRJ-700 -10%; 728Jet +2%; ERJ-170 +1%, ERJ-175 +5%, ERJ-190 +21%; ERJ-195 +28%; 928Jet +21%; A318 +37%; and 717 +38%.

The fuel price is calculated per region:

- Europe 89 cents per litre
- North America 85 cents per litre
- Australasia 95 cents per litre

US Regional

A US regional has lower crew costs than a major carrier. This confers a cost benefit on these airlines, while fuel and other costs remain almost unchanged.

Unit costs for aircraft in ascending order of size are shown (see second chart, page 22). As in the case of the US major, unit costs decrease for the 70-80 seat RJs with ascending size with the exception of the 728Jet.

A similar pattern is again followed with the larger RJs, with the 928Jet having a 1.05 cents higher unit cost than the ERJ-195.

The lower salary structure of the US regionals allows both the ERJ-190 and ERJ-195 to achieve lower unit costs than the 717 and A318. The unit costs of the CRJ-900 and 928Jet are higher than the 717 and A318. The main reasons for this are the mainline jets' higher seat capacity and their lower acquisition cost per seat.

All aircraft generate unit costs about 0.8 cents lower in this scenario compared to a US major airline cost structure, mainly due to lower salary scales.

The lower capacity RJs also demonstrate economics under this cost structure that are more likely to be acceptable to regional airlines.

Europe

Aircraft produce the highest unit costs in Europe compared to all other markets, with unit costs 0.2-0.6 cents per ASM higher than the US major airline scenario (see first chart, this page). The relative differences between aircraft types is similar to the US major and US regional airline cost structures.

While crew costs per ASM are similar to those of US regional carriers for all aircraft types, landing and navigation fees are about three times higher than in the US, making Europe the highest cost environment. The high weight-related charges also make the RJs more sensitive to these costs.

This factor favours the larger aircraft, although the European cost structure has not changed the relative differences between the types compared to either US scenario. The similarly sized ERJ-175 and CRJ-900 provide unit cost performance that makes these aircraft acceptable to airlines increasing seat capacity.

Australasia

The Australasian region has lower crew costs, but incurs larger fuel and spares costs. This is partly a reflection of the region's exposure to the US dollar. Unit costs are similar to those achieved by US regional carriers, and lower than the European situation.

The same relative positions of unit

ASM cost performance occur between aircraft types compared to the three other markets analysed.

Summary

The ERJ-195 is the best performing aircraft. Its seat capacity is only five seats smaller than the 717 and A318. This is due mainly to its combination of low acquisition cost per seat, but also its light weight contributing to low fuel burn. The ERJ-195 is also ahead of its RJ rivals.

The CRJ-700/-900, ERJ-170/-175 suffer from less seats and the 928Jet from a high purchase price. This has a significant effect on cost performance, but can be influenced by reducing the finance/lease rates on these aircraft. This illustrates that differences in pilot salary scales and weight-related charges in different regions of the world do not change the relative unit cost performance of the 10 aircraft analysed (see charts, page 22 & 23).

Barring pilot union issues and other barriers to utilisation by airlines, the ERJ-195 is the best fit in any market.

The smaller aircraft will play a role in market and traffic development. The ERJ-170/-175 appear to provide the most economic and logical addition to the ERJ-190/-195.

A major drawback for the 70-110 seat market development is US scope clauses, and how they affect this category. If the scope-clauses remain then most US 70-110 seat orders will go to Airbus and Boeing, although this analysis indicates that the 928Jet, ERJ190 and ERJ-195 can all compete with the two smallest mainline jets on offer, the 717 and A318.

With a combination of developing routes and retiring aircraft it appears that the 70-110 seat market has potential. Manufacturers will benefit if airlines overcome pilot union issues in the US.

A genuine market need is emerging in Europe where pilot contracts are not an issue. With the majority of replacements not due for some time, this market segment will develop slowly.

Airline consolidation has precluded any substantial RJ development in Australasia. Many small operators are delaying plans for expansion. 