The 30-seat market is a war confined to the ERJ-135 and Do 328Jet. The largest and most certain market by far is in the US. The ERJ-135 has the huge advantage of Embraer's customer base and strong economics and has already sold well. The Do 328Jet has its own advantages but these are of little use in the US market.

What future for 30-seat jets?

Recent events have witnessed the Embraer ERJ-135 repeating the sales success of the Canadair RJ and Embraer ERJ-145. In the light of this what future lies ahead for 328Jet?

To consider this and the whole future of the 30-seat jet market requires consideration of some fundamental questions:

- Where is the market?
- What is the size of the market?
- Which aircraft offers the best performance?
- Which manufacturer is likely to dominate?

Market base

The market for 30-seat jets is likely to be confined to North America. This is supported by a comparison of the passenger fleets of the Regional Airline Association (RAA) in the USA and the European Regional Airline Association (ERA).

In North America 30-seat aircraft still make up the majority of types in service. Less than 20% of the aircraft in service with RAA member airlines are in the 50 seats or higher category.

The situation in Europe is wholly different with the 19-seat aircraft all but extinct and 50-seat aircraft making up the largest share of total capacity.

Embraer

One of Embraer's advantages over the 328Jet has to be the strength of the market base for Embraer's Brasilia turboprop. Over 300 have been delivered, the majority to the USA. This also highlights a weakness, since Embraer could be accused of having neglecting the rest of the world, particularly Europe.

Even more important than the market base built up with the Brasilia is the success Embraer is having with the ERJ-135 and ERJ-145. Despite entering service over four years after the Canadair RJ the total orders for the two families are not dissimilar.

Regional airline and lessor orders total 829. Of these 588 (70%) are on order for US carriers. Europe accounts for 218 aircraft (27%) with the rest of the world accounting for the other 23 (3%).

The popularity of the ERJ-135/-145 family is best demonstrated by the backlog of nearly 300 for these two aircraft with few delivery slots available for the next two or three years. Even this does not take account of additional commitments in the form of over 400 options.

To meet this demand Embraer is ramping up production with output intended to be at 12 aircraft per month by 1999. Fairchild-Dornier in comparison is aiming to produce 24 328Jets in 1999 alongside eight 328 turboprops. This will rise to 42 and eight respectively by the year 2000.

Do 328 turboprop

The Do 328 turboprop failed to penetrate the market against stiff competition. Attempts to penetrate the US market were particularly unsuccessful. Ironically, prestigious launch customer Horizon Air was lost to Bombardier when Dornier refused to stretch the aircraft. Horizon's aircraft were subsequently placed with Mountain Air Express and Aspen Mountain Air, neither of which has proven to be a long-term airline success.

The overall result has been a less than inspired customer base with a number of smaller European carriers being complemented by a relatively high number of non-airline sales.

328Jet

The size of the order book for the Do 328Jet would appear quite good, except for the success that all other regional jets are experiencing.

The quality of the customer base is more worrying. One of the initial launch customers, US operator Aspen Mountain Air, which placed an order for four firm plus four options had its order cancelled after missing progress payments. The largest disclosed customer is German start-up EuroCityLine for nine aircraft. The largest order is for 10 aircraft to an undisclosed European operator believed to be another German start-up airline, Modernair. The orders from Midwest Express and Proteus, for 11, constitute the only real backlog from established regional airlines.

Considering that the 328Jet had a six month lead on the ERJ-135 the total number of orders placed does not compare well. The 328Jet also lacks the existing market base of the Embraer jets. In fact, the 328Jet relies heavily on new

customers because of the very limited market penetration achieved by previous commercial products from Dornier: the Do 228 and Do 328 turboprops. Fairchild achieved a phenomenal number of sales with the Metro family of 19-seat aircraft, but these are no longer used in great numbers by major regional airlines.

Market size

Without producing questionable forecasts for future deliveries it is worth considering that only one year after launching the ERJ-135 Embraer has sold 150 aircraft. This compares to the very respectable total of 212 for the ERJ-145. In the knowledge that 30-seat aircraft constitute the most popular size category in the US fleet it would not be unreasonable to suggest that the 30-seat jet market will be even bigger than the 50-seat jet which has already accounted for the sale of 631 aircraft.

Having concluded that North America represents the largest market for 30-seat jets how well is each manufacturer likely to perform? Since most regional airlines that will be taking 30-seat jets are either owned by, or affiliated with, the major carriers, it is worth analysing how these have reacted to the regional jet revolution.

Market penetration into the US for the ERJ-135 is already assured through sales of 120 aircraft before the aircraft has entered service. These have been strategic sales in the 30-seat jet contest, since at a stroke Embraer has secured two out of the six main airline groupings.

Fairchild-Dornier probably will not be much more successful with Delta. Although the Delta Connection 50-seat jet operators Atlantic Southeast, Comair and Skywest have focused on the Canadair RJ they also all operate large existing fleets of Emb-120s (Atlantic Southeast introduced the Emb-120 into service in October 1985). Of the other Delta Connectors, Business Express has already opted for the ERJ-135.

Comair was viewed by Fairchild-Dornier as a potential launch customer for the 428Jet. However, the airline's recent orders for the Canadair RJ are likely to have reduced this possibility.

The two Northwest Airlink partners, Express Airlines and Mesaba, are concentrating on building up fleets of Saab 340 aircraft and, in the case of Mesaba, Avro RJ85s. Neither 30-seat jet will have a head-start here.

United Express carriers Air Wisconsin and Atlantic Coast Airlines (ACA) have both selected the Canadair RJ to meet their 50-seat requirement, but Air Wisconsin offers hope for the 328Jet since the carrier has only recently taken over the Do 328 turboprop operation of Mountain Air Express. Neither carrier currently operates the Emb 120, although ACA did have a fleet of the type before these were replaced by the Jetstream 41.

US Airways must be high on the prospect list, since wholly owned subsidiary PSA Airlines already operates a fleet of 25 Do 328 turboprops.

Of the six major carriers, two are already firmly tied to the Embraer regional jets and one is very close to Embraer through the Brasilia turboprop. Northwest and United are fairly open, while Fairchild-Dornier has some advantage with US Airways. Overall, Embraer has the stronger position.

Designs

The design goal for the ERJ-135 was to achieve 90% commonality with the ERJ-145. After considering alternative engines, changes have been limited to the shorter fuselage and a few minor systems changes.

Changes from the Do 328 turboprop to 328Jet have been kept to a minimum to avoid unnecessary cost. The basic structure has been retained with strengthening where required. A stronger landing gear has been fitted to cope with the higher weights. Systems changes have been limited to more powerful generators and a dual hydraulics system.

Despite having achieved only moderate market interest in the 328Jet, Fairchild has already embarked on a further development of the basic 328Jet design in the form of the stretched 428Jet. Unlike the ERJ-135/-145, changes are not limited to insertion of fuselage sections. The 428Jet requires the design of a larger wing and the higher thrust requirements have required the development of a new PW300 derivative, the PW308B.

Commonality between the 328Jet and 428 jet aircraft will be high, but in the important area of powerplant commonality it will be less than between the two Embraer regional jets. The powerplant for the ERJ-135 is the AE3007-A3, which is simply a de-rated variant of the AE3007A fitted to the ERJ-145. In comparison the PW308B that will power the 428Jet is a 30% growth version of the PW306B powering the 328Jet, with a larger fan diameter. Interchangeability between the two aircraft will not be possible and an important commonality feature lost.

Seat capacity

The standard configuration of the ERJ-135 provides for 37 seats with space for both a forward galley and two separate wardrobes for carry-on stowage.

The 328Jet is offered with 32 seats in its standard configuration, but this only provides for a galley. Interestingly, the 328 turboprop was previously marketed as 30-seat with a forward stowage unit and only a single seat at the rear of the aircraft rather than the twin unit that the 328Jet is now showing. The standard galleys on both aircraft are very similar with capacity for two half trolleys in each.

The largest market for 30-seat jets is North America. The 328Jet's best features will gain it little advantage in the US market.

To equalise the facilities on each aircraft a carry-on stowage would have to be added to the 328Jet with the loss of at least one seat, bringing seat capacity down to 31. This gives the ERJ-135 a 20% larger capacity.

Passenger comfort

The Do 328 cabin is more passenger friendly than older 30-seat aircraft. The cabin was designed in the late 1980s to be superior to those of the existing aircraft by having wider seats (except for the Saab 340) and a wider aisle. This includes the Emb-120 from which the ERJ-145's and ERJ-135's fuselage was derived.

The ERJ-135 offers a big advantage in carry-on luggage capacity with larger capacity bins and more wardrobes and additional carry-on stowages.

Since the ERJ-135 is simply a shortended ERJ-145 it retains the aft baggage hold of the larger aircraft. This capacity, which was aimed to meet the needs of 50 passengers, is now greatly in excess of that provided by the 328Jet or any 30-seat turboprop.

Fairchild-Dornier claims noise levels in the 328Jet will be two to four decibels quieter than those in the turboprop, which was targeted to be no more than 78dBA over 75% of the passenger cabin.

The ERJ-135 is claiming average noise levels of about 80dBA. Early experience with the ERJ-145 indicates the original design aim to achieve 76dBA has not been met in practice.

Overall it is possible that the 328Jet will offer a marginally quieter cabin, but not enough to make an appreciable difference to passenger comfort.

Performance

At typical cruise altitudes between 31,000 feet for the ERJ-135 and 35,000 feet for the 328Jet the cruise speeds are 449 knots and 399 knots. Testing of the operational envelope for the 328Jet is continuing with the aim of pushing the maximum operating Mach number out to 0.70. This would increase the maximum cruise speed to 410 knots, still 39 knots slower than the ERJ-135.

The straight wing and low weight provide the 328Jet with a distinct take-off field performance advantage over the ERJ-135. The level of airfield performance provided by the 328Jet is close to that from the traditional turboprops like the Jetstream 41 and the Saab 340 (not the Dash 8-200) and superior to the ERJ-135's.

The ERJ-135 offers superior range capability to the 328Jet and can be increased further with an optional increased maximum take-off weight.

Economics

As long as an aircraft offers an acceptable capability in all other respects it is the overall economics that will drive a particular selection.

Direct operating costs have been calculated for the USA and Europe. The differences are summarised in the graph.

The economic comparison includes the Saab 340B+ to highlight the relative economic efficiency of the 30-seat jets against the traditional turboprops.

Aircraft in the USA are generally more heavily utilised than those in Europe. Analysing the average utilisation of Saab 340 operators in each region (top 50% only) gives a baseline of 2,000 flight hours (FH) for European operators and 2,500FH for North American operators.

With US tax based leases it is proving possible to produce lease rate factors in the order of 0.70% or even less. In Europe where the majority of carriers are less inclined to make the long-term commitments that are necessary to get these attractive financing terms, lease rate factors are nearer 0.85%.

Fairchild recently increased the 328Jet's list price from $10.95 million to $11.60 million. Embraer is reluctant to quote "list prices" but the last published list price for the ERJ-135 of $11.8 million is believed to have been increased to $12.0 million. The last published list price for the Saab 340B+ was $10.27 million back in 1996.

The ERJ-135's pricing takes no account of the Brazilian Governments Proex (interest rates equalisation system). Bearing in mind the current trade dispute with Canada/Bombardier, this issue is highly sensitive but the application of the scheme is believed to have the effect of reducing the effective price of Embraer's aircraft by around $1.5 million. This analysis does not take account of this benefit.

There is a significant increase in fuel consumption between the turboprops and jets. Over a typical 200nm sector there is a 65% to 95% block fuel increase but a 25% shorter flight time. The two jets have similar fuel burn performance.

Assuming that jets are operated on a power-by-the-hour type maintenance contract then the shorter flight times will reduce maintenance costs and so offset much of fuel cost increase.

The ERJ-135's fuel consumption is 15% higher than the 328Jet's but in terms of block fuel per seat the aircraft are very similar, since the ERJ-135 is also faster.

Since both aircraft have a similar technological standard, size and complexity it would be hard to justify why either would have significantly lower costs than the other.

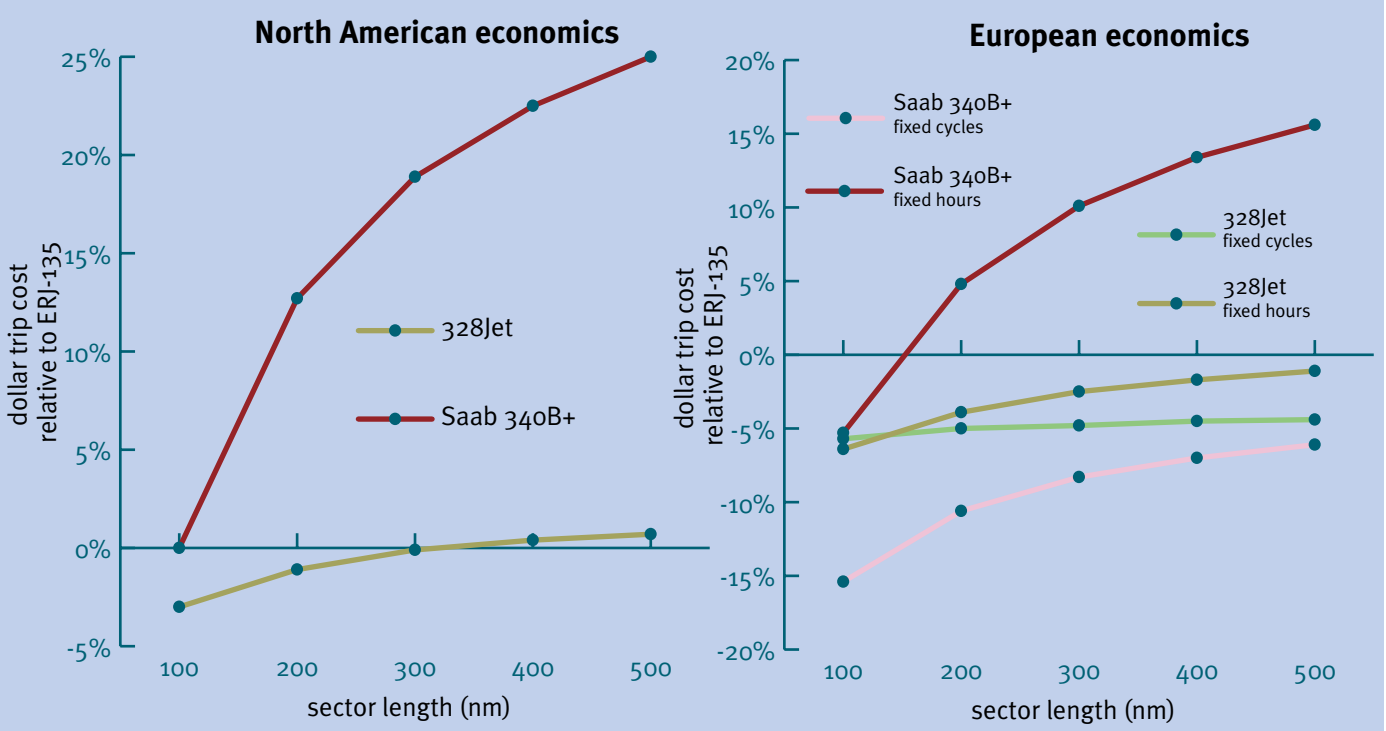
Manufacturer's data, however, suggests the ERJ-135 will offer maintenance costs 10% lower than the 328Jet. This difference is largely the result of the de-rated AE3007-A3 engine, which is claimed to offer 30% lower maintenance costs than the AE3007A powering the ERJ-145. If this proves to be the case then Embraer has a valid claim to its 10% cost advantage. If not the costs of the fully rated engine would have to be applied to the ERJ-135 and the difference between the two is reduced to less than 0.2%.

Obviously reality is somewhere between the two situations and for the purposes of the economic calculations the two aircraft are assumed to have the same maintenance cost.

The ERJ-135 is the heavier aircraft of the two even allowing for the increased optional weights on the 328Jet (19,000kg versus 15,990kg). The ERJ-135 will suffer higher weight related charges (landing and navigation) as a result.

North American economics

In the North American scenario it is assumed that the regional jets can achieve a utilisation that is only limited by the number of hours in the duty day. The result is a very economic aircraft compared to the slower turboprop. This is based on a utilisation of 2,500FH per



year.

A direct comparison between the ERJ-135 and the 328Jet shows they have very similar costs. Even on very short sectors the 328Jet only offers a 3% trip cost advantage over the ERJ-135.

For the US market the ERJ-135 offers direct operating costs comparable to the 328Jet but at the same time offers 20% higher seat capacity.

European economics

In Europe the higher landing charges the ERJ-135 suffers relative to the 328Jet will improve the comparison for the 328Jet, but by how much?

In the European scenario the most important consideration has to be whether or not regional jets can achieve the high utilisations they need to offset higher capital costs.

Two scenarios for utilisation are considered. In the first utilisation is limited to a fixed number of sectors per year. In other words the jets only match the sector utilisation of the Saab 340 and gain no benefit from their extra speed. The actual number of sectors is that achieved by the Saab 340 assuming an annual utilisation of 2,000FH.

In the second scenario utilisation is fixed at 2,000FH per year for all three aircraft, with the Saab 340 utilisation therefore remaining the same as in the first scenario and the faster jet aircraft achieving a higher number of sectors over the year. For practical reasons, slot limitations, aircraft positioning and lack of suitable additional routes the jet will never be able to fully utilise the theoretical utilisation advantage calculated by this scenario. Economic reality lies between the extremes.

For the scenario with fixed sectors the turboprop is undoubtedly the more economic solution with lower trip costs, although on a typical 200nm sector the difference is only 10%. For the second scenario with fixed hours the ERJ-135 is clearly the more economic with 5% lower trip costs. Now comparing the ERJ-135 with the 328Jet the latter can be seen to have marginally lower trip costs, about 4%, yet the ERJ-135 has eight extra seats and therefore 13% lower seat-mile costs.

Economically the ERJ-135 would appear to be the more attractive aircraft for both markets.

Market geography

With an economic performance that more than matches the only competitor (even without Proex involvement) there is very little reason to believe that North American operators will opt for the 328Jet.

For the rest of the world the one big weakness of the ERJ-135 is nothing to do with the aircraft itself but a continuing lack of faith in the manufacturer's commitment to any market outside of North America. In particular, customer support for Embraer products has been continually criticised. In this respect neither Fairchild nor Dornier fare much better. The regional manufacturer to beat has long been Bombardier.

The 328Jet's biggest weakness is that it does not have an established market on which to build.

It is unfortunate for the 328Jet that the advantages of superior cabin comfort, field performance and lower weight are of little importance to North American operators.

These advantages may be more usefully employed in other world markets such as Europe. Unfortunately there is little enthusiasm for the 30-seat aircraft either as a jet or turboprop. With capacity constraints, high salaries and other factors all leaving little possibility for profitable operation, Europe's regional carriers are continually moving into larger aircraft.

Conclusion

While the 50-seat jet market is contested by two strong players, Embraer can consider itself fortunate that the competition in the 30-seat jet market is much less formidable.

Embraer also appears to have gained some advantage relative to Bombardier in that the 30-seat aircraft is adding more sales to the overall ERJ-135/-145 programme than the 70-seat RJ Series 700 is adding to the Canadair Regional Jet family. The Series 700 has only recorded 51 sales since the programme was launched in January 1997 (after a long period of pre-design activity) compared to 150 from the ERJ-135 since September 1997. AC