

After 10 years there are still plenty of 70 to 110-seat jets. Few of the proposed aircraft have been developed. It is hard to see where the markets for these aircraft would come from, especially because of US scope clauses effectively blocking their sale.

What is the market for 70 to 110-seat jets?

Up until 1996 the 70 to 110-seat market was the subject of fierce competition between the British Aerospace (BAe) 146/Avro RJ and the Fokker 70/100. With Fokker's demise in 1996, BAe was left as the only supplier. But now that situation has changed.

In recent months there has been frantic activity as each regional aircraft manufacturer has announced its own project for this market. Which of these projects are likely to progress and what advantages do they offer?

Paper plane to reality?

There have never been more projects in the 70 to 110-seat category than there are right now, but how many are going to see the light of day? To put this into perspective, it is worth reviewing the large number of projects that have come, and gone before.

BAe studied the 146-NRA, a twin-engine 146 development before progressing to its original RJX, an all-new five-abreast A320 look alike.

Fokker offered the Fokker 80, which ultimately led to the Fokker 70, but the company never launched the larger Fokker 130. The latter was replaced on the drawing board by an all-new project, the Fokker FAX.

DASA, and its predecessor MBB, undertook lengthy project studies with China on the MPC-75, a 75-seater that was originally to have been propfan powered. These studies eventually led to the Regioliner R92 and R122, although without Chinese involvement.

At the same time Aerospatiale, in combination with Alenia and Casa, offered its rear-engined AAC90 and AAC120 designs, which ultimately merged with DASA's own studies as the DAA92/122. DASA's subsequent purchase of Fokker effectively killed off this activity.

For a short period ATR also looked at an ATR82, based on a stretched ATR72 with two under-wing mounted jets.

As well as European interest, IPTN of Indonesia offered its N2130 and Japan has been occupied for years on its YSX project for a YS-11 replacement.

US interest has not been great but in 1987 a group made up of Boeing, MBB, Fokker and IPTN studied a 90-seat UDF powered aircraft, the ATRA-90.

Ultimately all the European effort was merged into the AE316/317 project to launch an aircraft with Chinese industry, but again this project came to nothing.

All of this initial design activity highlights the enthusiasm of the different manufacturers. However, the lack of any tangible result clearly demonstrates the inability of any of them to put together a compelling business case.

Market size

The likelihood of projects being launched depends on the size of the market. This, in turn, depends on where that market is likely to be.

The 50-seat jets have been a success because of the US market. Of the 539 Canadair RJs (Series 100/200) currently

on firm order, 354, or 66%, are for US airline customers. The US dominance is highlighted even more by the Series 700: of the 96 aircraft on firm order, 82, or 85%, are destined for the US.

The size of the market for 70-seat jets is difficult to quantify since it is going to be very dependent on the US scope clauses. However, the market is likely to be small in comparison with that of the 50-seaters.

Bombardier and Embraer are building up monthly production rates of their smaller regional jets to eight and 12 units. By comparison, the rate for the Canadair RJ Series 700 will initially be set at four per month.

In some parts of the industry there was an expectation that the US scope clauses would be relaxed to allow the operation of aircraft with up to or greater than 70 seats. If anything the reverse is proving to be the case. Where carriers have been successful in introducing 50-seat jets it has been at the expense of larger aircraft. That is, the 50-seat jets have been allowed into the fleet on the basis that fleets of larger aircraft are limited or banned altogether.

Northwest recently gained concessions on the operation of 50-seat jets at the expense of a limit on larger aircraft. Northwest's partners are now allowed to operate 54 regional jets of up to 60-seat capacity. In return the Avro RJ85 fleet (configured with 69 seats to meet the previous scope clause) is now limited to the 36 on order.

The market for the 70 to 110-seat aircraft can be gauged more confidently by examining the success of the previous



The market for 70 to 110-seat jets depends to a large extent on US regionals extending their scope clauses to allow 70-seat aircraft. If anything the reverse is proving to be the case.

generation. It is interesting that BAe 146/RJ deliveries have stayed fairly constant, averaging 21 aircraft per year since the project began. The Fokker 70/100, on the other hand, peaked at 65 annual deliveries in 1993. On this performance it could be argued that Fokker created its own market with deliveries over the best years, 1991 to 1994, averaging 50 aircraft per year. However it is unlikely that Fokker could have maintained this level of orders. Manufacturers, such as Fairchild, which are planning production rates of five aircraft a month, (60 a year) are therefore likely to be disappointed.

At best the scope clauses may be extended to 70-seats, but large-scale sales of aircraft such as the 928Jet, ERJ-190 and BRJ-X to the US regional carriers are unlikely in the short- to medium-term. On this assumption it is debatable whether sufficient market exists in Europe alone to launch one, let alone all, of the new projects.

Development costs

Estimates for the cost to develop these all-new aircraft families vary widely. Bombardier and Embraer are the lowest, quoting \$650 million and \$750 million, respectively. The European manufacturers are probably taking a more realistic view, with Fairchild at

\$1,150 million and ATR \$1,200 million. This is where the Avro RJX has a definite advantage, since the cost to develop this derivative is put at around \$100 million.

Fairchild has stated it would only need 200 sales to break even. If we take the development cost of \$1,150 million and divide it over 200 aircraft, then of the \$20 million sticker price for each aircraft, only \$5.75 million will repay launch costs!

ATR Airjet

Rumours have circulated for most of 1999 suggesting that ATR and Fairchild are negotiating a regional jet alliance. Obstacles remain on a wide range of issues, including the location of final assembly and the selection of engine and avionics vendors. Configuration is more or less resolved, with recent details of the Airjet showing an aircraft that differs very little from the 728Jet.

Earlier rear-engined schemes have been replaced with a conventional low-wing design with under-wing mounted engines. Dimensions of the Airjet 100 and Fairchild 728Jet are almost identical, the wingspan being 5 inches different and the Airjet 200 being some 21 inches longer, which allows seating for one extra row, or five more passengers.

Bombardier BRJ-X

In almost every year since 1991 Bombardier has introduced a new commercial programme. These include: Learjet 31A (1991); CRJ-100 (1992); Dash-200 update (1995); Challenger 604 (1996); Global Express (1998); Dash 8-

400 (1999); CRJ-700 (2001); Continental Jet (2002) and BRJ-X (2003).

However the only all-new designs have been in the corporate market, namely the Learjet 45, Global Express and most recently the Continental Jet. The BRJ-X, if launched, would be the first all-new airliner development in the history of Bombardier!

Based on Bombardier's two most recent airline development programmes, the Dash 8-400 and the CRJ-700, the announced development milestones for the BRJ-X appear to be very optimistic: programme launch April 2000, first flight April 2002 and certification 2003.

The Dash 8-400 and CRJ-700 programmes are based on earlier designs and are planned to take 47 months from programme launch to certification. This compares with a stated 39 months for the BRJ-X, which will be an all-new aircraft with no commonality with earlier aircraft. The company may even introduce fly-by-wire controls for the first time in a Bombardier product.

In focusing the capacity of the BRJ-X in the 90 to 110-seat gap Bombardier is trying to avoid direct competition with its own CRJ-700. In doing so it is forcing itself almost into direct competition with Airbus and Boeing. Although the smaller BRJ-X-90 is equivalent to the Avro RJ100, the larger BRJ-X-110 will match the capacity of the A318 and 717-200.

As well as the obvious strength of this opposition, Bombardier would also have to take into account the considerable income that it derives from the manufacture of components for both of these companies.

Bombardier already has a 70-seat regional jet in the form of its CRJ Series

BAe has an immediate advantage because its development costs for the RJX only amount to £100 million. It is also less dependent on a high production rate.

700. It therefore has the least to gain of any of the regional manufacturers by launching a new project. At the same time, however, it understands the weaknesses of the CRJ-700; the narrow cabin, limited stowage volume and poor airfield performance and therefore, the threat posed by the all-new 70-seat jets.

If any of these are launched, the CRJ-700 would largely be forced to compete on price. This would obviously have a serious impact on Bombardier's profitability. With little possibility to stretch the CRJ-700 further, Bombardier is trying to cover the upper end of the market with the BRJ-X, while at the same time scaring off the competition.

Bombardier's problems could be eased substantially if rumours about its intended purchase of Fairchild prove to be correct. As it did over 10 years ago when Shorts was proposing to build an all-new regional jet, the FJX, Bombardier could simply buy the company. By taking over Fairchild it could close down one competitor, the 728Jet and almost certainly pick up further orders for the CRJ-700 from Lufthansa Cityline. It would probably maintain the German-based components business and possibly the 328Jet line to compete with the Embraer RJ135.

BAe Avro RJX family

BAe is closest to the launch of a new 70 to 110-seat regional jet programme in the form of its Avro RJX family. Unlike all the other projects, which are likely to remain paper planes, BAe has received conditional board approval to offer the aircraft.

The cost to develop the RJX is largely expected to fall on Allied Signal. This will presumably be recovered by charging a higher price for production engines. Hence the \$1.5 million increase in price for the RJX over the equivalent RJ.

The most significant 'condition' attached to the launch is that BAe must first sell the 20 or so unallocated current generation aircraft. Of the 153 on order, 34 remained to be delivered at the beginning of 1999. Assuming a production rate of two aircraft per month and that deliveries of the RJX will start in June 2001, there will be 58 more current-generation aircraft produced, leaving 24 to be placed. In reality, production of the RJX will probably start earlier and less than 20 aircraft will need to be allocated.

Firm options are held by Aegean (1) and Cityflyer (2). When Sabena placed its



order for the 23 Avro RJs in 1995 it also took up 15 options; Mesaba is also believed to have 24 outstanding options. Even discounting the Mesaba options, which will not be allowed within the latest Northwest scope clause, there remains enough options to take up most of the outstanding deliveries.

ERJ-170/ERJ-190

Embraer is a reluctant player in the game. Speculation is that the only reason Embraer went public with the ERJ-170/190 was because it was losing out in the competition to supply 50-seat jets to Northwest. The airline was known to be seeking a long-term solution for the replacement of its DC-9 aircraft. It seems hardly coincidental that Bombardier announced the Northwest order exactly one week after Embraer announced the ERJ-170/ERJ-190 programme.

Embraer is unique in having selected a four-abreast configuration for its project. Unlike the CRJ-700, the ERJ-170/190's cross-section will overcome all the criticisms of narrow seats and insufficient stowage volume aimed at the Canadian aircraft.

Fairchild 728Jet

After launching the 728Jet family in May 1998 Fairchild rapidly announced 'commitments' from four customers for a total of 165 aircraft. These include: Crossair (60), Lufthansa Cityline (60), Eurowings (30) and Proteus (15).

More recently momentum appears to have been lost on the 728Jet project. Both Crossair and Lufthansa Cityline

were originally scheduled to confirm their commitments by the end of 1998.

Crossair's initial enthusiasm for the project appears to have declined substantially as it has watched important design compromises being made to favour Lufthansa Cityline. Crossair is now evaluating the Embraer ERJ-170/190 prior to a decision by the end of June. Embraer is believed to be the current favourite, particularly since it is offering to design the ERJ-170 to be capable of operating from London City airport, something that is not possible with the 728Jet.

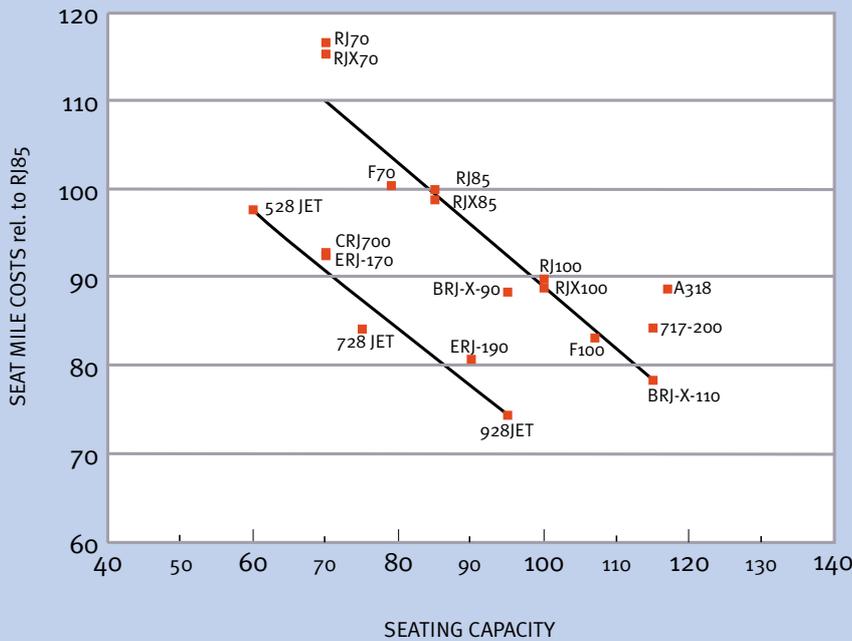
Lufthansa Cityline appears to remain committed to the type and is scheduled to confirm its commitment by the end of April. The airline is largely dictating the design of the aircraft and most importantly is constraining the size of the 728Jet aircraft to 70 seats to avoid any conflict with its pilots' union.

For the same reason Lufthansa rarely mentions the 928Jet. This 'scope clause' also limits the number of Avro RJ85 aircraft in its fleet. To circumvent this restriction Lufthansa Cityline is employing five Debonair BAe 146-200s on wet lease.

In addition to its orders for 55 CRJs (including 10 -700 aircraft) Lufthansa Cityline has very strong ties with Bombardier. CityLine Simulator and Training (CST) is a Berlin-based partnership with Bombardier and CAE which operates two Canadair RJ simulators.

Aside from Crossair and Lufthansa Cityline the only other two airlines that have made any form of commitment to the 728Jet are Eurowings and Proteus. The latter, although a loyal Dornier 328

COMPARATIVE SEAT-MILE COSTS OF 70-110-SEAT JETS



customer, appears to be swinging more towards Embraer, thus making its support for the 728Jet less likely.

Fairchild is convinced that it will be able to source the necessary development funding from its own cash reserves, risk sharing partners and grants from the Bavarian and German governments. As time goes on finding its own portion may be more problematic since there is little revenue from the existing product lines and already significant development expenditure on the 328Jet.

Even in the event that financing is forthcoming there remains a question mark over Fairchild's ability to design the aircraft. Dornier has never managed a successful commercial airliner programme, witness the 228, 328 and 328Jet, let alone one of the scale of the 728Jet.

The 328 turboprop was hardly without mishap during its development, with large-scale increases in drag and weight accounting for significantly slower speed capability and vastly increased power requirements than originally projected. Deliveries of the 328Jet are already behind schedule.

Economic comparison

Pricing for the new generation of aircraft has already been announced (see box).

Bombardier has not announced pricing for the BRJ-X, but when it does it will have to bear in mind the capacity and pricing of the CRJ-200 and -700. Extrapolating these linearly we can assume \$25.5 million for the BRJ-X-90 and \$28.0 million for the BRJ-X-90.

The BAe 146 suffered a significant disadvantage in terms of fuel consumption relative to the Fokker 100.

The initial Avro RJ offered no improvement in this area but Avro's policy of continual product improvement did reduce the gap and the RJX will finally overcome this disparity completely. Unfortunately for BAe the competition is no longer the Fokker JetLine but a new generation of project aircraft.

Both BAe and Fokker Services offer airframe maintenance programmes which in their most comprehensive forms cover all the elements of off-aircraft maintenance.

Similar programmes are available on the CRJ and the ERJ135/145 and presumably these would be extended to their 70 to 100-seat projects. At this stage very little detailed information is being supplied by the other manufacturers. It would be very difficult for a newly designed aircraft to achieve substantial savings relative to the Fokker JetLine and BAe 146/Avro RJs. This is because the same level of technology will be used in the rotatable components.

The perceived weakness of the BAe

NEW AIRCRAFT – PRICING	
Airbus A318	\$36.0m
ATR Airjet	Undisclosed
Avro RJX70	\$25.4m
Avro RJX85	\$27.4m
Avro RJX100	\$29.9m
Boeing 717	\$31.5–35.5m
BRJ-X-90	Undisclosed
BRJ-X-110	Undisclosed
ERJ-170	\$21.0m
ERJ-190	\$24.0m
Fairchild 528Jet	\$18.0m
Fairchild 728Jet	\$20.0m
Fairchild 928Jet	\$23.5m

146 and the Avro RJ has always been its four engines. In fact the problem with the engines on the BAe 146 was not only how many but how unreliable and expensive they were to operate.

Initial levels of reliability on the ALF502R-5 were poor by industry standards with very low intervals between shop visits. Although with the LF507 Allied Signal was prepared to offer power-by-the-hour (PBH) rates that matched those of the competing Rolls-Royce (RR) Tay 620/650, LF507 operators still only achieve 6,000 hours between shop visits. Generally, however, the LF507 has been a less troublesome powerplant for the majority of operators, particularly those in northern Europe with more temperate operating conditions.

The most vocal complaints continue to be made by SAM of Colombia where high temperatures, high elevation airfields and the thrust requirements of the RJ100 combine in a difficult operating environment.

Building on the achievements of the LF507, the all-new AS977 for the Avro RJX is claimed to offer a 20% reduction in PBH rate versus the LF507 and 30% versus the ALF502R. This is largely due to a doubling of the time on wing to 12,000FH.

In comparison with the ALF502/LF507, the RR Tay engine was an operator's dream, with superb reliability and 10,000FH on-wing times which is unheard of in any other regional engine.

For the CF34-8C1, which will power both the CRJ-700 and Fairchild 728Jet families, General Electric will be offering its ECMP-Engine Care Maintenance Programme. Although no engine selection has yet been made for the ERJ-170/190, for the purposes of the economic comparison it is assumed that the CF34-8 will be used, which is a contender.

The design philosophy behind the BR715 was to match the reliability and maintenance economy of the Tay while offering a 10% improvement in fuel economy. On this assumption the engine maintenance costs of the 717-200 are assumed to be the same as those for the Fokker 100. Since the BR715 is one of the choices available to the Bombardier BRJ-X, then the same data is assumed for this aircraft.

This leaves the A318. The design philosophy of the PW6000 is to achieve the same level of fuel economy as the BR715, but to do so with a much simpler engine. To allow for this effect engine maintenance costs are assumed to be at 90% of the Tay 650 level.

The aircraft proposed by Bombardier (unlike the proposals from ATR, BAe, Embraer and Fairchild) offers a high capability in terms of range and payload, but only by incurring a high weight penalty. The BRJ-X-90 is some 6,000lbs

The new 70 to 110-seat projects have the potential to offer 15% lower operating costs than their predecessors.



heavier than the similarly sized Avro RJ100 and Fokker 100.

Total operating costs

A number of assumptions have been made to arrive at the chart of seat-mile costs, so it should be seen as providing broad indications rather than precise data. What is clear, however, is that nearly all the new project aircraft can claim improvements in seat-mile costs in the order of 15% over the current Avro RJ/Fokker Jetline standard.

What is significant, however, is the lack of advantage offered by the BRJ-X family. The smaller BRJ-X-90 offers no significant advantage over the current standard and the seat-mile costs of the BRJ-X-110 are only 5% better than those of the 717-200.

Summary

Optimism surrounds the 70 to 110-seat market. It is not clear whether it is low estimates of development costs, ambitious development timescales or inflated estimates of market size. Ultimately finance, experience and a lack of conflict with existing programmes will be the prerequisites for a successful launch.

Both Bombardier and Embraer have the income from their smaller regional jets to finance such a development. ATR and, even more so, Fairchild, do not. In terms of ability, both Bombardier and Embraer can build on existing regional jet experience while ATR, through Aerospaziale and Alenia, has access to a wide range of knowledge. Fairchild,

however, lacks any large aircraft background and Dornier's commercial programmes have never been outstandingly successful. Discounting BAe's need to sell the interim aircraft, Bombardier is the only manufacturer with a product conflict, since any sales of the BRJ-X are bound to affect sales of the CRJ-700.

In the event that Bombardier does take over Fairchild then ATR is left without a strategic partner and with a slow moving turboprop product line. Unlikely to be able to fund a new jet from its own resources, ATR would be left as a niche player with a very uncertain future.

Bombardier is arguably the most likely to commit to a new project with its history of significant investment in both regional and corporate aviation. On analysis, however, the project it has come up with is too much like the 717/A318 with a small economic benefit. The recent World Trade Organisation dispute, and its effect on development subsidies from the Canadian government, may dampen Bombardier's enthusiasm.

It is assumed that Bombardier's business-orientated management would be unwilling to speculate in such a volatile market. The more likely action, based on historical performance, is that it will simply buy Fairchild. Rumours to this effect have been circulating now for weeks, and they have even been reported in the German press. Therefore the possibility that there is truth in the rumour has to be considered against Bombardier's earlier action against Shorts.

The most likely manufacturer to

launch its project aircraft is BAe. Since Allied Signal will largely fund the RJX development the only obstacle BAe has to overcome is selling its existing 20 or so unallocated current-generation aircraft.

Embraer, with its focus on the US market has, until recently, been very unenthusiastic about this size of aircraft. In December 1998 Embraer president Mauricio Botelho acknowledged that the US would dictate the market for the 70-seat jet and that: "as long as US scope clauses exist, this size of aircraft will not be allowed to operate within regional airlines."

If rumours about Embraer's commitment to the ERJ-170/190 being tied to the Northwest deal are even half true then the likelihood of an early launch seems remote.

The all-new 70 to 95-seat designs have the potential to offer a 15% improvement in direct operating costs relative to the current industry standard. To deliver this improvement the manufacturers will have to prove they can meet their pricing targets. These in turn will be based on an assumption of market size on which to amortise their development costs.

Like many of the projects that have come before, the current wave of interest in 70 to 110-seat regional jets may simply disappear. This would leave Bombardier and BAe to compete at the upper end of the regional jet market; Bombardier and Embraer to compete over the 50-seaters and Embraer to reap the benefits of being the only large-scale manufacturer of 30-seat jets. Unless, of course, Bombardier puts its weight behind the 328Jet!

