

The Dash 8-400 is only the second high-speed turboprop to enter the market, following the Saab 2000's failure. Unlike the Saab 2000, the Dash 8-400 has avoided development problems and offers an economic performance that should secure it a respectable sales volume.

# Dash 8-400: the right economics for Europe

**B**ombardier continues to offer the Dash 8-400 in a market that has difficulty appreciating the benefits of the high-speed turboprop. And a mass move by the industry towards regional jets suggests that the aircraft is likely to sell poorly. Although the Dash 8-400 follows the same design philosophy as the unsuccessful Saab 2000, could this forecast be an injustice? What does the future really hold for the Dash 8-400?

## The failure of Saab 2000

To answer this question it is necessary to understand the reasons why the Saab 2000 failed. Was its lack of success the failure of the high-speed turboprop concept, or were other factors

involved? Several suggestions have been put forward:

- 1 Delays & extended development
- 1 Poor marketing
- 1 Failure to penetrate the US market
- 1 Unattractive product.

## Extended development

The first deliveries of the Saab 2000 were targeted for September 1993, but did not happen until August 1994. Even the initial certification only covered the first five interim aircraft.

The most publicised problem was the Saab 2000's inability to meet the internal noise levels guaranteed to launch its customer Crossair. The active noise control system developed for the Saab 340Bplus had to be used, which took several years to develop.

The aircraft also had a shortfall in airfield performance, which was particularly damaging to Crossair. Furthermore, the aircraft had a problem with uncontrolled weight growth and escalating costs. Maximum take-off weight (MTOW) increased from 45,500lbs to 50,704lbs to meet range performance. And an increase in complexity had a corresponding impact on aircraft unit cost. These initial problems were cited as the cause when the programme lost momentum.

## Marketing

Another theory for the Saab 2000's lack of success was that marketing was ineffective. It failed to penetrate the US market, despite initial commitments from American Airlines, Business Express,

*While regional jets have found success in the US, helped by the turboprop avoidance factor, the high cost level of the European market means turboprops will still be the preferred aircraft for regional carriers. Because of traffic growth and congestion, there will be a good market for the Dash 8-400.*





*The Saab 2000 suffered a large number of setbacks. It has longitudinal stability problems, it did not meet internal noise targets, it had a shortfall in airfield performance and experienced weight growth. These all led to late certification. The aircraft failed to penetrate the US market and won a handful of customers in Europe. This left a legacy for all would-be high-speed turboprops.*

Comair, Northwest and Skywest (a total of 10 firm orders and 100 options). In fact, the only Saab 2000s sold in the US were the three aircraft in executive configuration delivered to General Motors.

Although a failure to penetrate the US market is a serious limitation to the fortunes of any regional aircraft, some have proved successful without it. For example, Fokker produced more than 200 Fokker 50s without a single sale in the US. And the bulk of the 370 plus Avro RJ/BAe 146s have been delivered, or subsequently passed on, to non-US operators. The final production total of 64 Saab 2000s (including the three prototypes) cannot be blamed solely on a failure to penetrate this market.

## Product

But despite all these perceived failings, the final conclusion has to be that the product itself was just not that attractive. It should be remembered that competitive pressure faced by the Saab 2000 was intense. As well as the Canadair RJ and, later, the ERJ-145, there were four other competing turboprop manufacturers, offering the ATR42 and ATR72, BAe ATP, de Havilland Canada Dash 8-300 and the Fokker 50.

At this stage it is worthwhile comparing the experience of the Saab 340 versus the Embraer Brasilia with the Saab 2000 versus the ERJ-145.

In both cases, the majority of the competitive aspects were similar. It is not surprising that both 30-seat turboprops achieved similar sales.

In the case of the Saab 2000 versus the ERJ-145, the only difference to the previous situation was that the Saab 2000 was driven by propellers. Since the Saab 2000 offered no intrinsic advantage over a jet, the retention of propellers killed it.

## Death of a concept

Once airline preference for jets became established, particularly in the US, the only way to overcome it was to offer a product with greatly superior economics. This was not the case with the Saab 2000. Economics are driven by aircraft price, maintainability, speed, weight and fuel economy. On almost every count the Saab 2000 offered no real advantage.

Unfortunately the majority of regional jet operators have chosen to fly their aircraft with 50 seats. The only way for the Saab 2000 to gain an advantage over the jets was to have 53 seats at a reduced pitch of 31 inches. Many operators would not accept this, since it would automatically have forced them to fly their aircraft with a second flight attendant, outweighing any increased revenue. The economics of Saab 2000 and ERJ-145 are therefore compared with 50 seats in both aircraft.

The most important consideration of price highlights the turboprop manufacturer's dilemma. The Saab 2000 and ERJ-145 are almost identical in terms of size and complexity, such that there are likely to be few differences in the actual cost to produce the aircraft. With a similar cost or price, the jet gains an enormous advantage. It can use its superior speed to achieve a higher

utilisation and hence offset the capital cost. The turboprop also has the burden of the jet avoidance factor.

Depending on world region, it would be difficult for an airline to justify paying its pilots less to fly a high-speed turboprop than a pure jet of similar capacity. There is therefore no cost advantage for the high-speed turboprop. In fact, once the potential for higher crew utilisation on the jet is taken into account it definitely has the advantage.

The difference in fuel consumption between the Saab 2000 and ERJ-145 is not a great one. Over a typical 200nm sector the Saab 2000 can claim up to a 15% advantage. Over longer sectors, say 500nm, on which the jet can achieve its higher cruising altitude, the ERJ-145 is able to reduce that difference to nearer 5%.

Since both aircraft are of a similar level of sophistication and technology the hourly cost to maintain the airframe and engines is practically identical.

Overall, with similar hourly costs the superior speed of the jet will substantially reduce trip maintenance costs.

In Europe weight-related charges account for a large part of the total direct operating cost. In purist terms a jet is structurally more complex and should suffer a weight penalty. It is one of the surprises with the ERJ-145 that Embraer has managed to achieve a similar payload range capability to the Saab 2000 with a MTOW that is 10% less.

The combination of a similar cost to produce and operate with a superior speed capability favoured the ERJ-145. Is this the same situation faced by the Dash 8-400 against its 70-seat jet competitors?



## Dash 8

Although the Dash 8 programme can be judged a success in the sense that more than 500 aircraft have been built, experience has shown that recent market conditions have been difficult.

The smallest members of the family have been the most successful. For the first 520 Dash 8s produced, the distribution by model was as follows:

Dash 8-100	298
Dash 8-200	77
Dash 8-300	145

The first 99 Dash 8s were all -100 models. After this the -100/-200 still outsold the -300 by two to one. The Dash 8 has proven particularly popular in north America with nearly 250 in service, despite fierce competition from Embraer and Saab.

Although never as popular as its smaller brothers, the -300 nonetheless is still in production as the only new-build alternative to the ATR42-500. Historically, the ATR42 has outsold the Dash 8-300 by a factor of around two to one.

An analysis of orders over the past four years highlights how Bombardier has battled through difficult market conditions. In 1995, Bombardier was at its most desperate to place aircraft. During that year it accepted orders from an Indian start-up, Archana Airways (two -200s); Pelangi Airways (four -200s and two -300s); Saeaga Airlines (one -200, one -300 and one CRJ) and Mesa

(25 -200s). Ultimately Archana and Pelangi never received any aircraft, Saeaga Airlines collapsed, placing two nearly new aircraft on the used market, and, Mesa cancelled its remaining order after the delivery of only twelve aircraft. Therefore, only 18 were delivered, including the two Saeaga aircraft.

Subsequent years have been better. The company received orders for 53 aircraft in 1996, 53 again in 1997 and 29 in 1998. Not one of these orders has been cancelled, although in some cases earlier aircraft have been traded back to Bombardier.

The European market, the second largest for regional aircraft, has proved more difficult to penetrate. Stiff competition from domestic suppliers limited the number of aircraft currently in service to less than 40. Nearly half are with Wideroe of Norway.

However, Europe has demonstrated a greater demand for the larger -300 aircraft. Of the first 145 aircraft produced about 60 are currently in European operation. Considering the number of -100/-200 aircraft placed in north America, the -300 should have expected a similar amount of success. However, discounting the Canadian domestic market, the Dash 8-300 has failed to penetrate Europe, the only operator being recent start-up, Shuttle America.

## Dash 8-400

Based on the experiences of both the Saab 2000 and the earlier Dash 8

*Unlike the Saab 2000, the Dash 8-400 has not suffered technical problems and has already secured 30 firm orders.*

variants, what are the prospects for the Dash 8-400?

After a protracted period, authority to offer the -400 was finally given in April 1995. Since then the aircraft has attracted a total of 30 sales, 17 of which are to SAS. The remaining 13 announced orders are all from existing Dash 8 operators. In comparison, there is a backlog of 96 orders for the Canadair RJ series 700, deliveries of which will not begin until 2001, two years after deliveries are scheduled to commence for Dash 8-400.

In reality, 30 orders prior to first delivery must be seen in the context of the more traditional regional aircraft experience. Regional aircraft programmes have always been launched on minimal initial orders and early availability has always been a key requirement keeping lead times and backlogs to a minimum. The industry preoccupation with regional jets is also working against the aircraft. Few operators are willing to take on the residual value risk of a type with such a limited market penetration. In a recent airline evaluation, which Bombardier subsequently lost, it attempted to overcome this issue by offering cash compensation if the aircraft went out of production within five years.

More important in the longer term is the quality of the customer base. SAS is a key customer that has never previously operated Dash 8 aircraft and has already firmed up two of its options.

Rheintalflug, Tyrolean and Wideroe all operate substantial Dash 8 fleets and constitute three of the top five operators in Europe. Further sales to these carriers can be expected along with sales from the other two major European operators, Augsburg Airways and Brymon. The latter already has options on two -400s, while Augsburg has options on seven further Dash 8 family aircraft, which can be converted for any series, including the -400.

It is worth recalling that at an early stage in the Saab 2000 programme there was an extensive customer base, many of who never finally committed to the type. At the time of the prototype's first flight Saab counted 46 firm orders and 147 options. With the exception of Air Marshall Islands and Skywest, each of these were loyal Saab 340 operators.

## The other 70-seat jet awaits its launch

This article has concentrated on the aircraft in the 70-seat market that are already either in service, or currently under development. Another type worthy of a mention here is the Fairchild 728Jet. While a firm launch date has still to be announced, an analysis of the economics of the type highlights some potentially very attractive figures, which could provide the CRJ-700 with some very serious competition.

There are a number of similarities between the two aircraft. Both offer similar speed capability and are powered by variants of the same engine. The CRJ-700 will typically seat 74 seats at 31-inch pitch but the 'standard' 70-seat 728Jet offers 32-inch seat pitch, two toilets (compared to only one on the CRJ-700) and substantially greater galley volume and on-board stowage facilities.

In a comparable, downgraded, standard to the CRJ-700, the 728Jet's cabin configuration should be considered with 80 seats at 31-inch pitch. Moreover, the 728Jet's cabin is a five-abreast configuration and also offers wider seats than the CRJ-700.

Neither manufacturer is disclosing sticker prices for their aircraft at this stage. Canadair will generally quote a range of between \$20 and \$25 million for the CRJ-700. Assuming a figure of \$22.5 million for the CRJ-700 and \$25 million for the 728Jet, the difference in overall seat-mile costs between the two aircraft is 2.5% in favour of the 728Jet when configured with 80 seats. The aircraft will also have a revenue-earning capacity advantage.

If the 728Jet is sold at the same sticker price of \$22.5 million as the CRJ-700 then the advantage to the 728Jet increases to 6.5%. The 728Jet just about matches the aircraft-mile costs of the CRJ-700 as well.

In addition to competitive economics the 728Jet will also overcome all of the negative passenger comfort features of the CRJ-700. Seats will be wider, overhead bin volume 50% greater and checked baggage volume 65% greater. Combined with superior airfield performance and family commonality, and with both a 50- and 90-seater proposed, the 728Jet would be the undisputed winner in any evaluation.

Launch orders are still to be placed for the 728Jet and its smaller and larger 528Jet and 928Jet counterparts. The CRJ-700's advantage is the high level of market penetration already achieved by the CRJ, particularly in the US with a large number of major regional carriers. Only Air Marshall

Islands and Crossair, the launch customer, actually took delivery of any aircraft.

Fortunately the competition for the Dash 8-400 is less severe than it was for the Saab 2000. Probably the biggest competitor is the ATR72-500. This has the benefit of a substantial market base, together with almost 100% commonality with the ATR42-500. The only jet competitor is a benevolent one, Bombardier's own Canadair RJ Series 700.

Despite the success of the Dash 8-100/-200 in the USA, penetration of this market with the Dash 8-400 must be seen as unlikely. The Dash 8-400 will be handicapped by both its turboprop powerplant and 70- to 74-seat scope clause limited capacity.

In Europe, the Dash 8 has struggled against the domestically produced ATR42/72 and Fokker 50. Despite this it has managed to build up a customer base of high-quality airlines. The European need for larger capacity aircraft and the demise of the other European manufacturers, with the exception of ATR, can only assist the Dash 8-400. Lacking appeal to the US market, the type's future must surely depend to a large extent on Europe.

One of the areas in which the Dash 8-400 has learned from the Saab 2000 experience is in family commonality. Although the major areas of spares commonality (in engines and avionics) relative to the earlier aircraft has been lost, there has been an

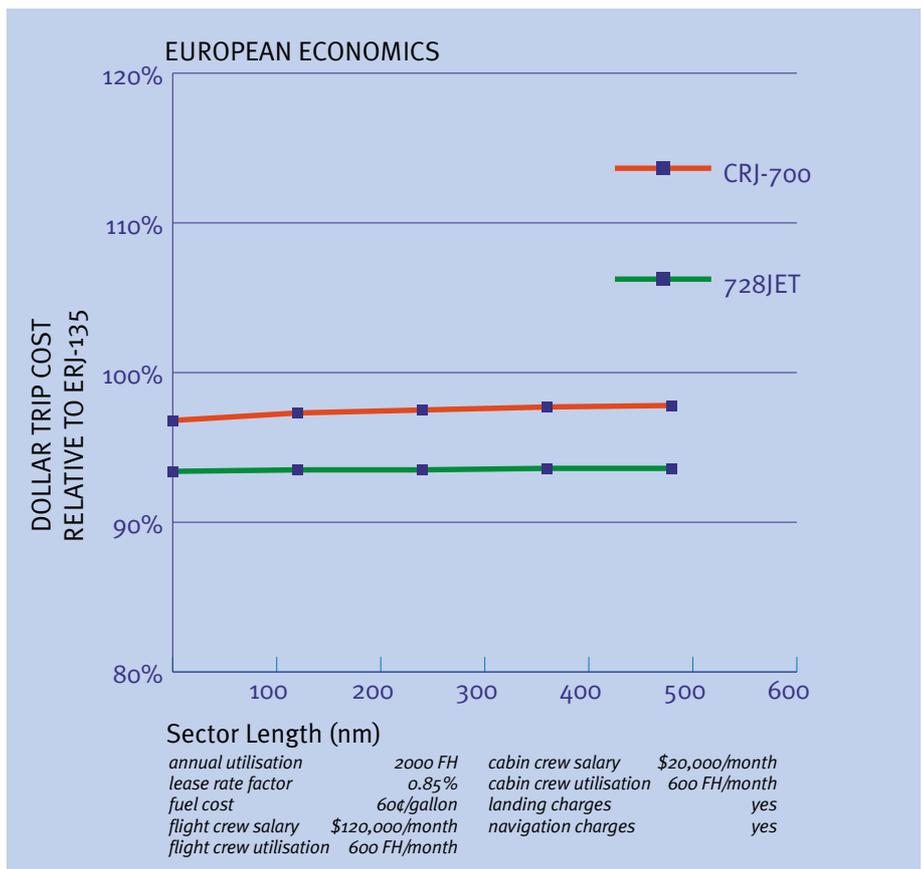
attempt to retain a degree of pilot commonality between the Dash 8-100/200/300 series and the -400. This will undoubtedly be an attractive feature. There has even been some discussion about SAS taking -300 aircraft with a common flight deck.

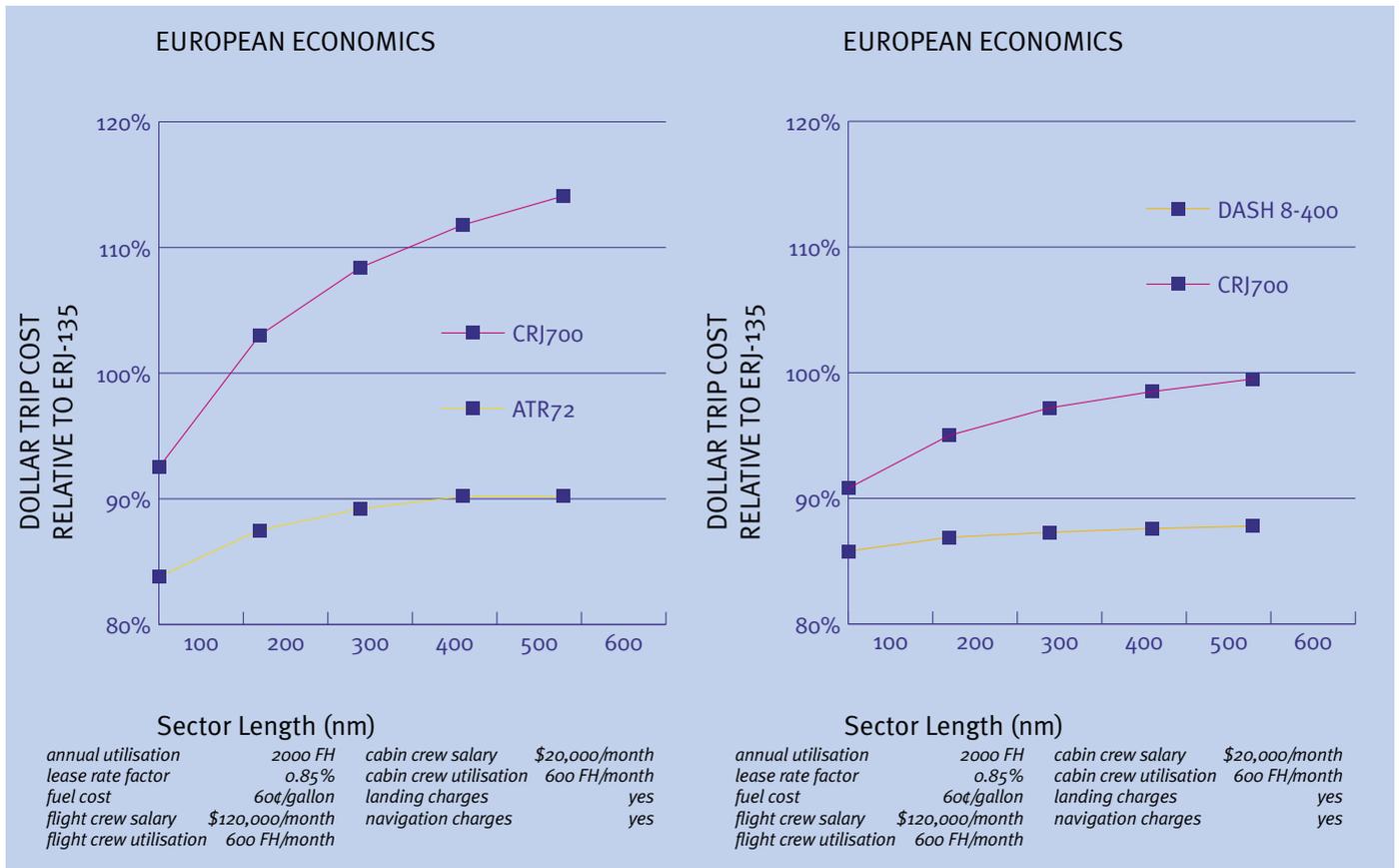
## Economic arguments

The Dash 8-400, like the majority of aircraft programmes, will succeed or fail on the strength of its operating economics. This is particularly important in Europe, which has high costs and where regional jets have not been as successful as in north America. If the Dash 8-400 can clearly demonstrate a significant economic advantage over both 70-seat turboprops and jets, particularly the CRJ-700, then it may succeed.

The aircraft has been compared on the basis of 66 seats for the ATR72 and 74 seats for both Bombardier products. These all provide 31-inch seat pitch layouts with similar levels of checked baggage capacity.

A simple comparison of list price for the three aircraft favours both the turboprops. Although the ATR72-500 has the lowest list price at \$16 million, when taking into account the larger capacity of the Dash 8-400, typically 74 versus 66 seats, then its \$17.7 million list price looks quite attractive. Bombardier appears reluctant to publicise a list price for the CRJ-700, but a price tag of \$20 to \$25 million is usually quoted. With equal seating





capacity, the CRJ-700 is 10–40% more expensive per seat. Two scenarios for utilisation are considered. In the first utilisation, the aircraft is limited to a fixed number of sectors per year. The faster aircraft gains no benefit from its extra speed in this scenario.

Utilisation is fixed at 2,000 flight hours (FH) per year for all aircraft in the second scenario. The faster aircraft therefore achieves 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 make full use of the theoretical utilisation advantage calculated by this scenario. Economic reality lies somewhere between these two extremes.

Obviously the higher speed of the Dash 8-400 and CRJ-700 gives the ATR72-500 a disadvantage. Typically, the Dash 8 will burn about 50% and the CRJ-700 about 65% more fuel than the ATR72.

Unlike in the Saab 2000/ERJ145 scenario, Bombardier has managed to retain some of the simplicity of the turboprop in the Dash 8-400. This corresponds to a difference of 20% in the hourly airframe maintenance cost against the CRJ-700.

Bombardier also claims the PW150 engines used on the -400 will actually have lower costs for repair and overhaul than the PW123 engines on the -300 model.

ATR is known to be concerned about the similarity in maintenance costs between the two engines. In reality, Pratt & Whitney Canada is likely to be aggressive on the guarantees that it will offer with the PW150, since the Dash 8-400 is the engine's only application.

Compared to the CRJ-700, the Dash 8-400 has maintained a 15% lower MTOW and so in Europe there will be a healthy difference in weight-controlled charges.

### Summary

As would be expected of a conventional turboprop versus a jet, the turboprop offers superior overall economics across short sectors and in circumstances when the jet cannot have a utilisation advantage.

The Dash 8-400 offers superior overall economics under all circumstances versus the CRJ-700 out to a 500nm range.

When considering the prospects for the Dash 8-400, comparison is naturally made with the Saab 2000. After the latter's demise, industry consensus was that the Dash 8-400 was doomed to follow. In reality the situation with the Dash 8-400 is today much more optimistic.

The Dash 8-400 can show some attractive economics relative to its closest competitors, including both conventional turboprops, such as the ATR72-500 and the CRJ-700 jet. This

makes the Dash 8-400's prospects in Europe particularly strong.

One great weakness of the Saab 2000 was a nagging doubt about the long-term future of Saab in the regional business. Saab never appeared to want to be a part of the industry consolidation and its only public stance was that the Saab 2000 would be the last aircraft it would develop in isolation.

In contrast, Bombardier has made a huge commitment to both regional and corporate aviation. The company on average launches a new programme every year, so similar concerns regarding Bombardier are unjustified.

One of the benefits of the turboprop is superior airfield performance. The Saab 2000 lost this advantage in the early years. Although such an advantage has never been enough to secure the viability of a programme, a classic example being Bombardier's own Dash 7, the turboprop can provide a firm foundation on which to build.

The design philosophy behind the high-speed turboprop was to offer turboprop economics with jet performance. The Saab 2000 failed to deliver turboprop levels of economics.

The Dash 8-400 with its combination of compelling economics and near jet speed more closely matches the original concept. This fact, together with the strength of Bombardier and good airfield performance, should ensure the type gains more success than its earlier counterpart. **AC**