

Turboprop orders for 2006 & 2007 are up to seven times the volume of 2002. High fuel prices and emerging markets are two of the main drivers for demand for the ATR72 and Q400. Analysis of the ageing turboprop fleet reveals the market should remain strong for the next 10 years.

# Turboprop market enjoys a revival

**T**he market for turboprops has regained its strength since its low point of just 24 firm orders in 2002 and 43 in 2003. The turboprop market was sidelined by 35- and 50-seat regional jets (RJs) in North America and Western Europe in the 1990s, and several turboprop manufacturers ceased production as demand from airlines weakened. This left the market to ATR and Bombardier, which are now enjoying higher levels of demand for new aircraft. Orders for turboprops have risen, reaching 141 aircraft in 2005 and 114 in 2006. This raises two key issues: why has the demand for turboprops increased in recent years; and which are the factors driving it?

## Renewed demand

As with RJs, the trend has been for most turboprop operators to gradually increase average aircraft size. This is due mainly to the desire to achieve lower unit costs per available seat-mile (CASM) because of constantly reducing passenger yields.

The average size of turboprops and RJs has generally been higher in Western Europe than in North America, mainly because of Europe's higher cost environment. Unsurprisingly, most turboprop orders over the past five years have been for aircraft in the 65- to 75-seat category.

There are four main explanations for the renewed demand: the replacement of

similar-sized turboprops; the replacement of smaller turboprops; the development and opening of new routes; and the replacement of RJs where airlines have found them to be too expensive.

Most turboprop orders have been for 65- to 75-seat aircraft over the past three to four years. This trend indicates that a main factor in renewed demand for turboprops is the replacement of 35- to 50-seat regional aircraft.

## Order activity

Firm orders for new turboprops reached a low in 2002 and 2003. With RJs being favoured by most airlines, orders for ATR and Bombardier turboprops totalled just 22 aircraft in 2002, with 14 going to the ATR72. These were spread between small orders that mainly came from existing customers.

The market rebounded in 2003, particularly for Bombardier, which received orders for 33 airliner versions of the Q300 and Q400. FlyBe placed its first larger order for the Q400, specifying 17. Qantas was the only airline to order the Q300.

Orders reached similar numbers in 2004, but climbed steadily during 2005. Flybe placed its second large Q400 order for 20 in 2005, while Qantas and Horizon ordered 7 and 12 respectively.



*Analysis of the turboprop fleet reveals reduction in the fleet of aircraft up to 40 seats. Orders for Q300s, Q400s, ATR42s and ATR72s are being placed to replace fleets of older F.27s, HS.748s and smaller types like the Saab 340.*

## TURBOPROP FLEET CHANGE FROM 2002 TO 2007

Turboprop size category	to 20 seats	21 to 35 seats	40 to 55 seats	65 to 75 seats	TOTAL
<b>2002 Fleet</b>					
Australia & NZ	125	87	25	8	245
Brazil	64	25	21	0	110
China			4	8	12
Japan & Korea	12	25	4	15	56
India	8		2	8	18
Europe	262	174	346	168	950
North America	679	737	135	66	1,617
<b>Total</b>	<b>1,150</b>	<b>1,048</b>	<b>537</b>	<b>274</b>	<b>3,008</b>
<b>2007 Fleet</b>					
Australia & NZ	98	94	49	18	259
Brazil	52	20	21	3	96
China				5	5
Japan & Korea	6	22	9	26	63
India	4	23	16	5	48
Europe	204	173	283	214	874
North America	564	433	97	51	1,145
<b>Total</b>	<b>928</b>	<b>765</b>	<b>475</b>	<b>322</b>	<b>2,490</b>
<b>Change 2002 to 2007</b>					
Australia & NZ	-27	7	24	10	14
Brazil	-12	-5	0	3	-14
China	0	0	-4	-3	-7
Japan & Korea	-6	-3	5	11	7
India	-4	23	14	-3	30
Europe	-58	-1	-63	46	-76
North America	-115	-304	-38	-15	-472
<b>Total</b>	<b>-222</b>	<b>-283</b>	<b>-62</b>	<b>49</b>	<b>-518</b>

The Q400 won a total of 48 orders in 2005. The ATR72 won 63 orders in 2005, including 30 from Air Deccan and 20 from Kingfisher Airlines. The total for the two aircraft was 111, which exceeded the number for smaller turboprops for the first time. The ATR42 and Q200/300 won 20 firm orders in 2005.

Total orders for 2006 reached 110 aircraft, with 93 of these coming from larger turboprops. The Q400 won 37 orders, with Porter Airlines ordering 10, Luxair three to replace its ERJ-145s, Croatia Airlines four, and Frontier ordering 10.

The ATR72 won 56 firm orders. This included a second order from Kingfisher Airlines for 15, and 10 from Aer Arann.

Orders to date for 2007 have totalled 140, and already exceed those for 2005 and 2006. Large turboprops account for 117 of these. The ATR72 has won 63 orders, with Jet Airways of India ordering 13 ATR72s, and Malaysia Airlines and Batavia of Indonesia 10 each.

The Q400 has won 54 firm orders in 2007 with 15 each from Pinnacle Airlines, Horizon Air and FlyBe.

While turboprop orders have been strong in all global areas from 2005, the

new Indian market has clearly provided a large number of new sales. Airlines in the Asia Pacific, such as Cebu Pacific, Bangkok Airways and Berjaya Air, show that there is potential for new routes.

It is also interesting that orders for large turboprops have exceeded those for 70-seat jets since 2005. Sales of the CRJ-700 in particular have lagged behind the ATR72 and Q400.

The reduction in CRJ-700 orders in 2007 compared to 2006, and the continuing pace of E-170/-175 orders, perhaps illustrates the appeal of these two jet types to different markets. The CRJ-700 is more suited to regional operations, and so compares more directly with the ATR72 and Q400. The E-170/-175, and their larger counterparts the E-190/-195, are being ordered by airlines that serve different markets to the large turboprops.

## Turboprop fleet

An examination of the global turboprop fleet in the main markets of the world over the past five years provides a macro-indication of what fleet planning strategies airlines have followed.

Turboprops can broadly be divided

into four size categories: aircraft up to 20 seats; aircraft from 21 to 35 seats; aircraft from 36 to 55 seats; and aircraft with 65 or more seats.

The first group includes types like the BAE J31; Fairchild Metro II, III and 23; Emb-110; Dornier 228; and the Dash 6. It also includes several minority types.

The second group includes the ubiquitous Dash 8-100/-200, the BAE J41, the Emb-120, the Saab 340, and the Dornier 328.

The third group includes the E.27, Fokker 50, Dash 8-300, Saab 2000 and ATR42.

The fourth group has the fewest types, and includes the Dash 8-400/Q400, ATR72 and BAE ATP.

The majority of aircraft are operated in North America and Western Europe (*see table, this page*). In North America, the development of regional carriers to provide feeder services to major carriers first saw large numbers of 20- to -35-seat turboprops being ordered by US and Canadian operators in the 1980s. Demand for turboprops in the two larger categories was weaker.

These smaller turboprops were then partially replaced and added to by 35- and 50-seat RJs from the mid-1990s.

Europe's regional carriers have followed a similar pattern of development, but 50-seat turboprops were the most popular in the 1980s, with smaller aircraft being uneconomic in many cases. Fifty-seat RJs have had some success with European regional airlines, but larger RJs have had the highest levels of demand.

Prior to 2000, the other major turboprop markets have been Australia and New Zealand, Japan and South Korea, and Brazil.

The Indian sub-continent has emerged as a major turboprop market since 2000. ATR has won the largest number of orders here, with Air Deccan, Kingfisher, and Jet Airways ordering large numbers of ATRs, in particular ATR72s. Air Deccan has ordered 30 aircraft, Kingfisher 35, and Jet Airways seven.

The total number of turboprops in these four size categories and for these seven markets fell by more than 520 aircraft from 2002 to 2007 (*see table, this page*). The two smallest size categories have seen the largest reductions, losing about 500 aircraft. The 65- to 75-seat category has seen an increase of 50 units over the period, which has offset the reduction of 62 aircraft in the 40- to 55-seat fleet (*see table, this page*).

The number of turboprops has changed little in some global regions, while there has been an increase of 30 aircraft in India, representing a 150% increase over five years. The number of aircraft in Europe has fallen by 76, but the biggest change is in the US where 472

*Air Deccan and other Indian airlines are just some examples of airlines that taking advantage of emerging markets.*

fewer turboprops are in active service compared to 2002. The North American fleet has seen the biggest reductions in the two smallest size categories, but also lost 38 aircraft in the 40- to 55-seat bracket. It has also actually lost aircraft in the 65- to 75-seat bracket. This is explained by the large retirements of ATR 72s carried out by American Eagle and Trans States Airlines.

## Sub-fleets

### To 20 seats

The number of aircraft up to 20 seats in these seven main markets has declined by 222 (see table, page 36). The majority of aircraft in this category are operated in North America and Western Europe, and fleets here have declined as aircraft in this category have lost favour with operators.

There are several examples of US operators reducing their fleets of Beech 1900Ds since 2002. These include Air Midwest, Commutair, Corporate Airlines, Great Lakes Aviation, Mesa Airlines and Skyway Airlines.

There have also been several reductions of smaller turboprops in Western Europe, by operators including Eastern Airways, Olympic Airways, and Regional of France.

### 21 to 35 seats

A larger reduction in the 21- to 35-seat turboprop fleet by 283 units has been seen in these major markets, particularly in the US where the number of aircraft has fallen by 300 since 2002. This is mainly due to operators of Saab 340s, Dash 8-100/-200s, Emb-120s and J41s replacing them with 35- and 50-seat RJs.

The number of aircraft in this category has increased to 23 from zero since 2002, illustrating India's potential as a major turboprop market.

### 40 to 55 seats

The 40- to 55-seat category of turboprops has experienced a smaller change in fleet size, with 63 fewer aircraft operating in Europe and about 38 fewer aircraft in North America compared to 2002.

Europe has a mix of airlines: some have reduced their fleets of F.27s, Fokker 50s, Dash 8-300s and Saab 2000s, and replaced them with larger turboprops or



RJs; others have increased their fleets through acquisitions of used aircraft and new ATR42s; and start-up airlines.

SAS Commuter, Botnia, Regional of France, Eurowings, Air Dolomiti, Luxair, Air Nostrum, Swiss and KLM UK are all examples of 50-seat turboprop fleet reductions. BA CitiExpress, which operated 13 Dash 8-300s, was merged with other British regional carriers to form BA Connect, which was subsequently sold to FlyBe. These Dash 8-300s have been phased out.

These disposals provide one side of the story in Europe, however. Several carriers have increased their turboprop fleets in the 50-seat class. VLM of the Netherlands, for example, has added seven Fokker 50s since 2002. Air Baltic, owned by SAS, has added five Fokker 50s, and Denim Air has added four. Carpatair of Romania has grown rapidly and added 12 Saab 2000s to its fleet over the past five years.

Fifty-seat turboprops were less common in the US, and some fleets have been replaced over the past five years with RJs. This includes American Eagle, the Continental feeder ExpressJet and the ex-TWA feeder Trans States Airlines.

Fleets of 50-seat turboprops have grown in Australia and New Zealand, however. Eastern Australian Airlines and Air Nelson have added five and 15 Dash 8-300s to their fleets since 2002.

In India, which has become a market with strong potential, Air Deccan is one of three major carriers that have developed turboprop operations, taking delivery of 11 ATR42s over the past five years. Alliance Air has taken delivery of four aircraft.

There are 40 outstanding orders for ATR42s and Q200/300s.

### 65-plus seats

The largest size bracket of 65- to 75-seat turboprops is the only group to have increased in size since 2002, and is the size category which has won the majority of new orders in recent years. This group has only seen a net increase of about 50 aircraft, however (see table, page 36). There are outstanding orders for another 226 aircraft in this category.

The main markets in this group are North America, Western Europe, Australia and New Zealand, Japan and South Korea, and India. The net increase of 49 aircraft is a combination of the older BAE ATP and some ATR72s being retired by several airlines, especially in Europe. These include Finnair, Eurowings, Aegean Cronus and KLM UK. Large numbers of ATR72s have also been retired by airlines in the US, including: 30 by American Eagle, which have been re-assigned to American's subsidiary, Executive Airlines based at San Juan in Puerto Rico; and eight by Trans States Airlines.

A large number of aircraft have also been added to fleets. Many small additions of ATR72s have been made in Europe by Cimber Air, Airlinair, CCM Airlines, Contact Air, Aer Arann, Air Dolomiti, Alitalia Express, and Farnair Switzerland. Dash 8-400s/Q400s have also been added by Austrian Arrows (previously Tyrolean), Augsburg Airways and Wideroe. The largest increase in Europe, however, has been Flybe, which has increased its Dash 8-400 fleet by 27 aircraft. Its current fleet is 33, and the airline has a further 27 aircraft on order.

Large turboprops have been less popular in North America in recent years, but Alaska Airlines' regional subsidiary,



Horizon Air, has added 16 Dash 8-400s over the past five years.

Japan and South Korea have also been a major market, with Japan Air Commuter adding 10 Dash 8-400s to replace 12 YS-11s. All Nippon Network, has added 12 Dash 8-400s, Jeju Air five, and Air Central two. Hansung Airlines has added four ATR72s.

India is a major market for large turboprops. The three main airlines are Air Deccan, Jet Airways and Kingfisher. Five years ago, Air Deccan and Kingfisher did not operate any turboprops, but Air Deccan now has nine ATR72s with 21 more on order, while Kingfisher has 12 ATR72s and another 23 firm orders outstanding. Jet Airways has yet to take delivery of its ATR72s, and there are a total of 140 outstanding orders for ATR72s. The Q400 has another 86 outstanding deliveries. This indicates how the fleet of this category of aircraft will develop.

## Market drivers

Taking firm orders from airlines since the start of 2002, ATR has won the majority to date with 258. Bombardier is close behind with 233. When orders for 2007 are ignored, the two manufacturers are almost equal.

The majority of orders are for the 65-seat-plus category, accounting for 386 of 491 orders taken. The remaining 105 are from the 50-seat category, with the ATR42 winning 51 and the Dash 8-200/-300 54.

The majority of these orders are for the replacement of older turboprops, such as the HS.748, F.27 and YS-11, and for the development of turboprop route

networks.

Orders for turboprop replacements have come from Pakistan International Airlines, Air New Zealand, Air Algerie, Binter Canarias in the case of ATR; and All Nippon Airways, Japan Air Commuter, Qantas, Air New Zealand and Austrian airlines in the case of Bombardier.

Some orders for route network development and growth have come from Air Deccan, Jet Airways and Kingfisher Airlines, Aer Arann and Malaysia Airlines in the case of ATR; and Flybe and Horizon Air in the case of Bombardier.

Only a minority of orders for turboprops have been made for the direct replacement of RJs. One example is Luxair, which ordered Q400s to replace ERJ-145s.

While aircraft have not necessarily been ordered to replace RJs, the resurgence in turboprop orders has been at the expense of 35- to 50-seat RJs. Firm orders for ATR and Bombardier turboprops from 1st January 2004 total 426 units. This compares to 654 orders for RJs up to 50 seats, and 257 orders for larger RJs over the same period.

The majority of turboprop orders over the past four to five years has been for the ATR72 and Q400. The total of 385 for these two aircraft types compares to 592 firm orders for jets in the same size category: the CRJ-700 and E-170/-175. Orders for these jets exceeded turboprop firm orders up to the end of 2006. Orders for large turboprops in 2007 are twice those won by the CRJ-700 and E-170/-175.

Sales of large turboprops for the first nine months of 2007 have exceeded firm

*Flybe has followed the clear strategy of a two-type fleet. The Q400 is used on sectors that have flight times of up to 55 minutes. Flybe claims the Q400 has a lower trip cost than a similar-sized jet and equal to a 50-seat jet.*

orders for the whole of 2006. A main factor behind this is the continuing rise in oil and fuel prices: the turboprops have 60-80% lower fuel burn than the similar-sized jets. The downturn in 70-seat RJ orders, however, is mainly related to the CRJ-700, with the E-170/-175 continuing to achieve steady sales.

An example of turboprops being used in different markets to jets is UK carrier Flybe. Flybe adopted the strategy of offering UK domestic services and flights to services to Western Europe from a variety of airports in the UK that are alternatives to London's congested Heathrow and Gatwick. Flybe has a two-type fleet, with the 78-seat Q400 being used on UK domestic services and shorter routes to France that have flight times of up to 55 minutes. The E-190 is used on longer European routes.

"The Q400 is economical on sectors of up to 55 minutes, and there would be no benefit to passenger demand or yields by offering RJs instead of a turboprop," says Andrew Strong, chief operating officer at Flybe. "We use the aircraft within the UK from airports such as Southampton, Birmingham, Exeter, Glasgow and Belfast. Not only does the Q400 have a lower trip cost than a similar-sized RJ, but the Q400's trip cost is about the same as a 50-seat RJ with an advantage of 28 more seats. The Q400's fuel burn, for example, is about half that of a 75-seat jet. Pilot salaries between a 50-seat RJ and Q400 are about the same in our case, and the Q400 as slightly lower maintenance costs.

"On a cost basis, the Q400 can also operate eight sectors per day for the same trip costs as four daily sectors with a smaller version of the 737. While the total number of seats for either option would be similar, the Q400 allows an airline to offer twice the service frequency," continues Strong. "The Q400's cruise speed of 360 knots and high rate of climb means that it is an economic alternative to jets up to a flight time of 90 to 110 minutes. The E-190 is the preferred aircraft for flights of two hours or more, or where traffic densities are high enough to justify their capacity."

Not only has Flybe selected the Q400 in preference to RJs, but it has ordered 60 aircraft to satisfy demand on its growing route network.

## GLOBAL TURBOPROP FLEET AGE ANALYSIS

Turboprop size category	to 20 seats	21 to 35 seats	40 to 55 seats	65 to 75 seats	TOTAL
<b>Age group</b>					
To 1977	404	68	146	0	619
1978 to 1987	811	295	144	0	1,250
1988 to 1997	1,532	738	526	219	3,015
From 1998	133	101	175	304	713
<b>TOTAL</b>	<b>2,881</b>	<b>1,202</b>	<b>991</b>	<b>523</b>	<b>5,597</b>

## Operating economics

A main factor in the selection of turboprops instead of RJs in recent years has been the operating cost advantage of turboprops. The four main elements of operating costs that vary with aircraft type are fuel, maintenance, flightcrew and aircraft financing or depreciation charges. Passenger yields have continued to decline and airlines are under constant pressure to reduce cost per available seat mile (CASM) and total cost per seat.

The cost of fuel increasingly affects aircraft selection. Prior to 9/11, the unit cost of fuel was 60-80 cents per US Gallon (USG). This price was low enough not to dissuade regional airlines from operating RJs, despite their fuel burn being higher than that of similar-sized turboprops. The unit cost of fuel has approximately tripled to \$2.3-2.5 per USG, and this price increase has amplified the difference in fuel burns between large turboprops, 50-seat RJs and larger RJs.

The cash operating costs of 50-seat RJs are similar to those of 65- to 75-seat turboprops. This is illustrated by the fuel performance of aircraft in these categories. Taking a 400nm trip as an example, the ERJ-145 and CRJ-200 burn 415USG and 440USG on a trip of this length, while the 65-seat CRJ-700 burns 550USG. In contrast, an ATR 72-500 burns 380USG on a 400nm trip, and the Q400 490USG.

The Q400's higher fuel burn relative to the ATR 72 is explained by the Q400's larger engine and higher cruising speed. The Q400 has a 20-minute shorter flight time on the same trip, however.

At current fuel prices of \$2.4 per USG, these differences in fuel burn have an impact on total operating costs. The ATR72's fuel burn, for example, is equal to a cost of \$900, compared with the ERJ-145's cost of \$990 and CRJ-200's cost of \$1,040. The Q400's fuel cost is higher at \$1,170, but this is offset by it having 28-33 more seats than the ERJ-

145 and CRJ-200.

The CRJ-700, similar in size to the ATR72 and having 10 seats fewer than the Q400, has a fuel burn cost of \$1,440.

Another main element of cash operating costs is maintenance, of which engine reserves form a large part.

Engine reserves for the PW120/121 powering the ATR42 are \$130 per engine flight hour (EFH), and \$145 per EFH for the PW127E/F. The larger PW150A on the Q400 will have higher reserves than the PW127E/H.

The reserves for the CF34-3B1 and CF34-8C powering the CRJ-200 and CRJ-700 are higher at \$175 per EFH. This higher reserve is equal to a higher engine-related maintenance cost of \$60-90 per FH for the CRJ-200/-700 over the ATR42/72.

These two examples show that the ATR72's and Q400's cash operating costs are close to those of smaller jets and lower than those of similar-sized jets. The high unit fuel prices amplify the advantage that turboprops have over RJs.

## Market prospects

The turboprop market is clearly benefiting from high oil and fuel prices. An examination of the global fleet of Western aircraft reveals that out of 5,600, about 1,800 aircraft are more than 20 years old (*see table, this page*).

The analysis of the fleet also reveals that 2,881 aircraft are small, with up to 20 seats, and another 1,200 are in the second size category of 21-35 seats.

Two general trends in the turboprop market are that aircraft are often operated until they reach 25-30 years of age, and that airlines replace aircraft with larger types. More than 4,000 of the turboprop fleet, therefore, have fewer than 35 seats. More than 1,500 of these are older than 20 years (*see table, this page*). These 1,500 aircraft are therefore the most likely replacement candidates.

Another 991 aircraft are in the 40-

55-seat category, representing an opportunity for replacement with larger turboprops.

While some of these aircraft may be replaced with RJs, many operate in markets where yields are too low to sustain jet operations. There will be a strong market therefore for medium and large turboprops for a sustained period.

There are a small number of younger generation turboprops in storage that can satisfy some of this demand. This includes 12 ATR72s, 32 ATR42s, seven Saab 2000s, 12 Dash 8s and 13 Fokker 50s. There is also a larger number of BAE ATPs, F.27s, HS.748s and Convair 580s in storage. Demand for these older aircraft, however, will probably be limited, and conversion to freighter is their likely future.

The remaining replacement market will therefore clearly still be large after the best-quality stored aircraft have been absorbed.

In addition to the replacement of older aircraft, there is also the demand for new aircraft to satisfy growth. Clearly the larger types are in most favour here, since airlines are under increasing pressure to lower unit costs per ASM.

Not only are the traditional markets showing strong demand for the Q400 and ATR72, but new markets are also emerging. Bombardier has secured orders from SA Express, Arik Air in Nigeria, and Tassilli Airlines in Algeria for the Q400. Jeja in South Korea, Air Philippines and Fly Baboo in Croatia have also ordered the Q400.

There are further opportunities in Latin America, and the potential of China and India is established. India's orders for turboprops may have only shown a fraction of their potential, since the country still has several infrastructure constraints that have so far limited the number of aircraft that can be operated.

Russia has also experienced strong traffic growth in recent years, and there are several other emerging markets. ATR says that Cebu Pacific and Malaysia Airlines are examples of two airlines with untapped potential for turboprops.

The replacement of BAE 146s/Avro RJs and Fokker 70s is another example of potential orders for large turboprops.

It is even possible that some regional carriers in the US may retire a portion of their 50-seat RJ fleets and revert back to turboprops.

Market forecasts vary, but the smallest predictions are that 2,000 turboprops, ranging in size from 15-90 seats, will be needed over the next 20 years. This is equal to an average demand of 100 aircraft per year. **AC**

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