Turboprops can be a more efficient solution than RJs on shorter sectors. The potential demand for a new 90-seat turboprop is examined here. About 188 suitable routes were identified across Europe, North America and the Asia Pacific.

Is there a market for a 90-seat turboprop?

Fuel-efficient turboprops have seen a new lease of life in recent years, as airlines have faced consistently high fuel costs.

Despite a recent reduction in fuel prices, the major turboprop manufacturers believe their aircraft will remain in demand as airlines seek to hedge against future fuel cost increases, as well as maintain a competitive unit cost per available seat-mile (CASM).

The average size of commercial turboprops has increased over the past 20 years, with a shift towards aircraft with capacity in excess of 70 seats.

High fuel prices and the increasing trend for the use of large aircraft have led to speculation regarding the potential for a new, larger 90-seat turboprop design.

Aircraft Commerce has analysed the current large turboprop market and the potential demand for a new 90-seat aircraft. The potential advantages of a 90-seat turboprop compared to similar-sized regional jets (RJs) are discussed here. Airport-pairs with the appropriate sector lengths and average capacity for a 90-seat turboprop are identified.

Turboprops versus jets

If a 90-seat turboprop is introduced, its main competition will come from regional jets (RJs). The closest competing RJs would be the E-175, CRJ900 and SSJ100-95, as well as the E-175 E2 and MRJ90 when they enter service.

Turboprops can have economic and operational advantages over RJs in certain circumstances.

Economics

"Turboprops are more economic than RJs on short routes where there is no benefit from the jet's faster cruise speed," claims John Moore, head of global sales at ATR.

Moore offers an idea of the efficiency savings that can be generated by an ATR72-600 in comparison to similar-size, in-production RJs. This excludes new aircraft still in development and testing. "A turboprop's cash operating costs can be 30-40% less per trip on a typical 250 nautical mile (nm) sector," he claims.

Moore explains that a turboprop's lower cash operating costs are the result of lower fuel, maintenance, crew, and navigation and airport costs.

"An ATR72-600 can burn up to 50% less fuel than a similar-sized RJ on a typical 250nm route," claims Moore. "A turboprop's direct maintenance costs can be up to 40% lower per flight hour (FH) than those of an RJ, because turboprops have simpler systems, lighter structures and less installed power. The lower operating weights of turboprops can result in 25-30% lower navigation and airport fees."

Navigation fees and airport landing or departure charges are usually based on aircraft weight, so the heavier RJs will incur higher costs.

Staff salaries also have an impact on cash operating costs. "Crew salaries are generally 15-20% lower for turboprops," says Moore.

Bombardier claims that a Q400's operating costs per seat can be 15% lower than those of similar-size, in-production RJs. A Q400's costs can also be 50% lower than those of out-of-production RJs. Bombardier also claims that the Q400's fuel burn per-seat can be 30% lower than in-production RJs; and 35% less than older, out-of-production RJs. This is based on a 250nm sector.

Turboprops have optimum propulsive efficiency and fuel burn at slower cruise speeds than RJs.

The RJs' speed advantage over turboprops means they have shorter block times. This has little influence on comparative operating costs on short routes, but an RJ's block time advantage increases with longer stage and route lengths. At certain sector lengths, the RJ's advantage in block time performance may allow it to operate more sectors than a turboprop in a single day, thereby generating more available seat miles (ASMs) than a turboprop. This advantage in seat-mile productivity can offset, and begin to outweigh, a turboprop's lower cash operating costs.

Turboprops are used on some very short sectors, but also on some much longer ones.

"Scheduled passenger operations with ATR aircraft range from sectors of just nine nm to 890nm, but most activity is on routes of up to 300nm," says Moore.

Turboprops are generally considered to remain economically competitive with RJs on sectors of 350-400nm.

Bombardier believes its Q400 remains competitive over longer distances. It says the aircraft is most often used on sectors of 200-500nm, but also has the faster speed and range to be deployed on routes of up to 1,000nm.

Bombardier claims the Q400 has the flexibility to operate at both turboprop and jet-like speeds that can be achieved on regional routes. They can therefore be profitably used on short-range turboprop missions, or medium-haul jet markets. "The Q400 has a cruise speed of up to 360 knots compared to 280 knots for other turboprops," says Ross Mitchell, vice president business acquisition, Bombardier Commercial Aircraft. "The crossover point, or route length, where a jet becomes more economic than a turboprop never really happens with the Q400 due to its additional speed."

Turboprops can be more economic than RJs on shorter sectors. On a 250nm route, a Q400's operating costs per seat can be 15% lower than similar-sized in-production RJs, and 50% lower than out-of-production RJs.

Operational flexibility

"Turboprops have higher operational flexibility than RJs, which makes them well suited to regional airports," says Moore. "They have better short field performance. Their lower approach speeds allow operations on shorter runways, and offer more manoeuvrability for airports with difficult access.

"Turboprops also have fewer operating limitations than RJs," adds Moore. "They are more capable of operating steep slope approaches and from narrow or unpaved runways. Another benefit is that less infrastructure is needed to support turboprops, such as fire-fighting cover and hangar space."

Manufacturer's perspective

The largest turboprops currently available are the ATR72 and Q400. ATR and Bombardier are therefore the most likely candidates to launch a new 90-seat turboprop programme.

ATR

ATR is a specialist turboprop manufacturer. Its highest capacity aircraft is the ATR72.

The ATR72 first entered service in 1989. There are 581 ATR72s in passenger service, including 208 of the latest -600 series. There are 253 ATR72-600s on order backlog.

The ATR72-600 first entered service in 2011. Compared to older variants, the ATR72-600 has improved avionics, more cabin space and enhanced performance.

An ATR72-600 can typically seat 68-74 passengers. In a standard four-abreast, single-class layout with a 30-inch seat pitch, it can seat 70 passengers.

ATR is not planning to introduce a larger turboprop at this time, but does not rule out the possibility of doing so in the future.

"We believe there will be a market for larger 90-seat turboprops as part of the industry trend towards upgauging," says Moore. "ATR will continue to survey this market and opportunity. Designing a new larger aircraft in the 90-seat class is not a priority, however." ATR believes it can satisfy the market requirements in the large turboprop segment.

"Our primary focus is to further develop our current aircraft family to ensure that it remains as attractive and competitive as possible," continues Moore. "The aim is to develop solutions to improve engine efficiency and overall operating costs, while providing even higher standards of comfort and navigation aids."

One planned development is an increased capacity version of the ATR72. "We are working on a 78-seat configuration that will be certified in late 2015," says Moore. This will be achieved without changing the ATR72's fuselage length.

Bombardier

Bombardier's Q400 is the highest capacity turboprop currently available.

The first Q400 entered service in 2000.

The current Q400 variant is the Q400 NextGen. The Q400 NextGen features an enhanced cabin environment with LED lighting, new ceiling panels and larger overhead luggage bins. The first Q400 NextGen was delivered in 2009.

There are 435 Q400s in active passenger service, including 58 Q400NextGens. Bombardier had announced firm orders for 541 Q400s and Q400NextGens as of 31st March 2015. Of these, 487 have been delivered.

The Q400 NextGen is available in standard, dual-class, high-capacity and combi configurations.

In a standard single-class, four-abreast cabin configuration, a Q400 NextGen can accommodate 70-78 passengers, depending on the seat pitch.

In a dual-class cabin the aircraft can accommodate 67-74 seats.

"Five years ago we saw some demand from operators for a turboprop with a capacity of 90 seats," says Mitchell.

Bombardier's response was to develop an extra capacity configuration for the Q400, through an internal cabin reconfiguration, rather than any physical alterations to the size of the aircraft.

"We realised that the vast majority of airlines did not need the baggage hold capacity provided at the front of the cabin," explains Mitchell. "The removal of the forward baggage hold and the use of slimmer seats allows more seats to be installed in the Q400 NextGen."

Bombardier's extra capacity configuration for the Q400 NextGen has been available since 2014. In a single-class, four-abreast, extra-capacity configuration, the Q400 can seat up to 86 passengers with a 29-inch seat pitch.

Nok Air in Thailand was the first carrier to operate the extra-capacity Q400 NextGen. As of 31st March 2015, four had been delivered to Nok Air.

The development of the extra-capacity configuration for the Q400 NextGen means Bombardier currently has no plans to introduce a new larger turboprop. "We believe the extra-capacity configuration will meet some of the demand for a larger aircraft," says Mitchell.

"We are happy with where we are today in terms of our turboprop offering," he continues. "We will have to wait and see if additional demand exists for a turboprop with a capacity over and above the 86 seats offered by the extra capacity Q400 NextGen configuration."

Engine OEM

Pratt & Whitney Canada (P&WC) is the dominant engine manufacturer in the regional commercial turboprop market. It

An ATR72 can currently accommodate up to 74 passengers. ATR is developing a 78-seat configuration. On a 250nm sector, ATR72-600's operating costs per trip can be 30-40% less than those of similar-sized in-production RJs.

believes there is a market for a new 90-seat turboprop, and is already developing an engine suitable for such an aircraft.

"P&WC has confidence in the 90-passenger regional turboprop market and we will be ready when an aircraft is launched," says Richard Dussault, vice president of marketing at P&WC. "We are completing the demo programme for our new Next Generation Regional Turboprop (NGRT) engine and will continue to look at technology insertions.

"The NGRT engine will incorporate our latest technologies to serve as a fully integrated powerplant system platform for a 70-100 plus passenger turboprop," continues Dussault. "The market wants significant improvements in performance and reliability over current engines. A clear differentiator is competitiveness and maintaining a fuel burn advantage over the next generation jets. Our NGRT will be a totally new centreline engine, which we believe will deliver well over 20% fuel burn improvement over today's next generation regional jets.

"A key step in our technology demonstrator programme is the testing of the compressor for the NGRT engine," adds Dussault. "The high-efficiency compressor is a core element of the new engine. The first phase of testing has been completed successfully and the second is almost complete. Our analysis has shown opportunities for optimisation in terms of propeller system integration, air bleed extraction and electrical loading. We are also working with new manufacturing technologies that require more elaborate planning, high-tech tooling and more extensive development."

A new turboprop engine might require a new propeller system.

Aircraft Propeller Service is a commercial propeller maintenance and repair organisation (MRO).

"It is likely that a 90-seat turboprop would need a larger engine than currently available, but the propeller system would not necessarily have to be more complex," says Dennis A. Santare, vice president of sales and marketing at Aircraft Propeller Service. "If the new engine required more blades, or was much larger, the maintenance costs would grow somewhat linearly in line with blade count, and less than linearly with the size of internal materials."

Potential demand

About 75% of ATR72s and Q400s operate in Europe, North America and the Asia Pacific.

2015 schedule data from these regions have been analysed to identify the possible level of demand for a 90-seat turboprop. This is assessed by identifying the number of airport-pairs that have appropriate sector lengths and an aircraft size that indicates the need for a notional 90-seat turboprop.

For the purposes of this analysis, qualifying airport-pairs are those with sector lengths of up to 500nm and an average capacity of 85-95 seats in both directions of travel.

Most turboprops operate on routes of up to 300nm, but some have higher cruise speeds allowing them to remain competitive with RJs over longer distances. It is possible that a new 90-seat design would have similarly high cruise speeds, which is why slightly longer sectors of up to 500nm are included here.

Any new 90-seat turboprop is likely to have a variety of cabin configuration options. In this case a potential capacity range of 85-95 seats was considered realistic. Any airport-pairs with average aircraft size at the lower end of this scale will therefore also be suitable for extra capacity Q400 services.

Schedule data from 2005 and 2010 have also been analysed to identify any growth trends in the number of airport-pairs suitable for a 90-seat turboprop over the past 10 years.

Europe

Since 2005, there has been a 15% growth in available seat capacity on shorter European routes with sector lengths of up to 500nm. One potential factor in this growth might be the opening of new routes, and the extra capacity introduced as result of the expansion of the European Union (EU). Airlines based in EU member countries are permitted to operate services between two member states outside of their home country, and to operate domestic services in member countries outside of their home state.

In 2015, more than 501 million seats will be available on internal European routes of up to 500nm. The capacity provided by turboprops and widebodies has decreased since 2005, while the available seat-miles (ASMs) provided by narrowbodies and RJs has increased.

The largest origin markets for flights of up to 500nm are Germany and the United Kingdom (UK).

Turboprops will account for more than 56 million seats on routes of up to 500nm in 2015. That is, about 11% of all capacity. In turn, about 90% of these turboprop seats are provided on routes shorter than 300nm.

Turboprop capacity on routes of up to 500nm actually decreased by 7% from 2005 to 2015. During the same period, the average turboprop size increased from 50 to 59 seats.

This was partly due to an increase in the seats provided by ATR72s and Q400s. There are 129 ATR72s and 129 Q400s in active passenger service with European airlines.

The largest European Q400 operators are Flybe (45), Austrian (18), Air Berlin (17), Air Baltic (11), and Wideroe (11). Prior to 2015, Austrian's Q400's were operated by its subsidiary Tyrolean. The two carriers officially merged in April 2015.

TOP 20 SUITABLE ROUTES FOR A 90-SEAT TURBOPROP IN EUROPE BASED ON TWO-WAY CAPACITY IN 2015

Airport Pair	Origin Country	Destination Country	Seats	Flights	Av Seats	Sector Length (nm)
London City (LCY) - Edinburgh (EDI)	UK	UK	788,819	9,026	87	291
London City (LCY) - Amsterdam (AMS)	UK	Netherlands	747,004	8,184	91	186
Palma Majorca (PMI) - Ibiza (IBZ)	Spain	Spain	722,099	8,149	89	76
London City (LCY) - Dublin (DUB)	UK	Ireland	690,901	7,786	89	255
Porto (OPO) - Madrid (MAD)	Portugal	Spain	685,703	8,021	85	237
Warsaw (WAW) - Krakow (KRK)	Poland	Poland	408,052	4,607	89	133
Goteborg (GOT) - Copenhagen (CPH)	Sweden	Denmark	395,236	4,495	88	124
Warsaw (WAW) - Wroclaw (WRO)	Poland	Poland	384,116	4,476	86	165
London City (LCY) -Glasgow (GLA)	UK	UK	375,272	3,936	95	304
Alicante (ALC) - Madrid (MAD)	Spain	Spain	353,990	4,164	85	192
Riga (RIX) - Stockholm-Arlanda (ARN)	Latvia	Sweden	344,758	3,698	93	250
Birmingham (BHX) - Duesseldorf (DUS)	UK	Germany	338,642	3,969	85	323
Helsinki (HEL) - Kuopio (KUO)	Finland	Finland	338,102	3,936	86	181
Amsterdam (AMS) - Brussels (BRU)	Netherlands	Belgium	336,097	3,718	90	85
Vienna (VIE) - Warsaw (WAW)	Austria	Poland	314,886	3,412	92	297
Paris-Orly (ORY) - Perpignan (PGF)	France	France	310,000	3,478	89	360
Madrid (MAD) - Toulouse (TLS)	Spain	France	305,000	3,211	95	290
Frankfurt (FRA) - Basel (BSL)	Germany	Switzerland	297,401	3,207	93	153
Madrid (MAD) - Santander (SDR)	Spain	Spain	294,508	3,353	88	177
Hamburg (HAM) - Copenhagen (CPH)	Germany	Denmark	293,320	3,355	87	150

Source: Innovata

Notes: Figures for each airport-pair include both directions of travel. Seat and av seat numbers are therefore based on two-way capacity. Excludes members of the CIS.

Flybe, Austrian and Wideroe have all increased the size of their Q400 fleets since 2005. Flybe and Austrian also removed Q300s from service during this period. Air Baltic introduced Q400s to replace Fokker 50s.

The largest European ATR72 operators are Flybe Nordic (12), Stobart Air (12) and Swiftair (12).

Stobart Air was formerly known as Aer Arann, and operates franchise services on behalf of Aer Lingus and Flybe. It increased the number of ATR72s, and reduced the number of ATR42s in its fleet from 2005 to 2015.

European routes

The number of intra-European routes considered suitable for a 90-seat turboprop decreased from 2005 to 2010, but has grown again in the past five years.

In 2005 there were 105 suitable routes, but this fell to 78 in 2010.

In 2015 there are 110 intra-European routes suitable for a 90-seat turboprop. These airport-pairs have sector lengths of 500nm or less, and an average capacity of 85-95 seats per sector.

These 110 routes will provide 20.4 million two-way seats on nearly 230,000 flights. That is, the number of seats and operations in both directions on these routes. Just over half of the routes have sector lengths of 300nm or less.

The five largest of these airport-pairs will each support more than 500,000 two-way seats in 2015 *(see table, this page)*.

The 10 largest routes include two domestic services in each of the United Kingdom (UK), Poland and Spain.

About half of the busiest 20 airport-pairs are international services. The geography of Europe means that there are relatively short distances between many countries.

The largest of the 110 routes, in terms of capacity, links London City (LCY) with Edinburgh (EDI).

Four of the 10 largest routes serve LCY. In addition to EDI, these include flights between LCY and Amsterdam (AMS), Dublin (DUB) and Glasgow (GLA).

LCY has a number of operational restrictions which limit the type of aircraft certified to operate from the airport. The short field and steep approach capabilities of turboprops make them particularly well suited to operating from LCY. If a 90-seat turboprop were to maintain these operational capabilities it could be a suitable platform for services from LCY.

The airport with the most originating capacity among the 110 routes is Munich (MUC). It will provide more than 1.3 million one-way seats (in one direction) on services to 16 destinations. These include domestic German services and international destinations, such as Basel (BSL), Luxembourg (LUX), and Zagreb (ZAG).

The next largest origin points by capacity are LCY and Madrid (MAD).

Many of the 110 routes are served by multiple airlines using different aircraft types. On a given airport-pair, one airline might operate narrowbodies or large RJs, while another uses small RJs or turboprops. It is this mix of operators and aircraft that often results in an average capacity of 85-95 seats.

An example is the airport-pair linking Palma Majorca (PMI) with Ibiza (IBZ) in Spain. In 2015 this route is flown by four airlines using a mix of narrowbodies, large RJs, small RJs and turboprops. The average capacity is 89 seats per flight.

Some of the 110 routes are operated by a single airline using several aircraft types. An example is LCY-GLA, which is operated by BA CityFlyer using a mix of 98-seat E-190s, and 76-seat E-170s. The result is an average capacity of 95 seats per flight in 2015. A 90-seat turboprop could be the optimum solution on this 304nm sector.

North America

In this analysis internal North American flights are classified as those within or between the United States (US) and Canada.

Since 2005, available capacity has declined by 17% on internal North American sectors shorter than 500nm. In 2015 about 397 million seats will be available on these sectors. The number of seats provided by turboprop, narrowbody, and widebody aircraft has fallen since 2005. The number of seats provided by RJs has increased by 2%.

Turboprops will provide more than 53 million seats on sectors of up to 500nm in 2015; about 13.5% of the total capacity. About 80% of these turboprop seats will be flown on sectors of 300nm or less.

The average size of turboprop services on sectors of up to 500nm increased from 27 to 34 seats from 2005 to 2015.

In 2005, more than half of the

TOP 20 SUITABLE ROUTES FOR A 90-SEAT TURBOPROP IN NORTH AMERICA BASED ON TWO-WAY CAPACITY IN 2015

Airport Pair	Origin Country	Destination Country	Seats	Flights	Av Seats	Sector Length (nm)
Washington National (DCA) - New York La Guardia (LGA)	USA	USA	1,556,650	18,099	86	186
Sacramento (SMF) - Los Angeles (LAX)	USA	USA	1,389,193	14,651	95	324
Seattle (SEA) - Spokane (GEG)	USA	USA	1,371,551	15,024	91	194
Detroit (DTW) - Chicago O'Hare (ORD)	USA	USA	1,267,961	14,731	86	204
Cleveland (CLE) - Chicago O'Hare (ORD)	USA	USA	1,031,593	11,842	87	275
Buffalo (BUF) - New York-JFK (JFK)	USA	USA	790,182	8,331	95	261
Chicago O'Hare (ORD) - Pittsburgh (PIT)	USA	USA	779,111	9,010	86	358
Houston (IAH) - Austin (AUS)	USA	USA	697,188	7,503	93	121
St.Johns (YYT) - Halifax (YHZ)	Canada	Canada	650,559	7,341	89	477
Calgary (YYC) - Comox (YQR)	Canada	Canada	565,263	6,070	93	358
Nashville (BNA) - Charlotte (CLT)	USA	USA	543,746	5,787	94	286
Fort McMurray (YMM) - Calgary (YYC)	Canada	Canada	525,085	6,096	86	348
Atlanta (ATL) - Knoxville (TYS)	USA	USA	516,323	5,440	95	132
Nashville (BNA) - Washington National (DCA)	USA	USA	513,584	5,756	89	488
Reno (RNO) - Los Angeles (LAX)	USA	USA	498,694	5,807	86	339
Washington National (DCA) - Indianapolis (IND)	USA	USA	468,918	5,535	85	434
San Francisco (SFO) - Palm Springs (PSP)	USA	USA	445,434	4,949	90	366
Boston (BOS) - Richmond (RIC)	USA	USA	441,326	5,079	87	412
Fargo (FAR) - Minneapolis St Paul (MSP)	USA	USA	417,868	4,892	85	194
Detroit (DTW) - Grand Rapids (GRR)	USA	USA	409,564	4,365	94	104

Source: Innovata

Notes: Figures for each airport-pair include both directions of travel. Seat and av seat numbers are therefore based on two-way capacity.

turboprop capacity on sectors of up to 500nm was operated by aircraft configured with 30-37 seats. This included Dash 8-100/200s, Saab 340s and Embraer EMB-120 Brasilias.

Since 2005 the number of seats operated by turboprops on North American services of 500nm or less has declined by 15%. There has, however, been an increase in the percentage of turboprop capacity provided by larger aircraft, including Q400s and ATR72s, over the same period.

The Q400 is the dominant large turboprop in the North American market in 2015. There are 153 Q400s in passenger service with US and Canadian airlines, compared to just nine ATR72s. The largest North American Q400 operators are Horizon Air (52), Republic Airlines (26), Porter Airlines (26), Jazz (20), and WestJet Encore (19).

In the US, regional aircraft such as large turboprops are often used to feed traffic into the hubs of major carriers. They are normally operated by a third-party airline under capacity purchase agreements (CPAs) with a major carrier, and will fly under the major airline's regional brand.

Republic Airlines has CPAs with United Airlines. In September 2014 Republic announced that it was amending its Shuttle America E-Jet CPA with United to add 50 new 76-seat E-175 aircraft.

It also announced that its Q400 fleet will be removed from United's service between January 2015 and September 2016. Republic has agreed a sub-lease deal with Flybe for 24 of its Q400s. Republic says that its remaining aircraft will be sold, leased or returned to the lessor.

This development means that Horizon Air will be the only significant operator of large turboprops in the US. It also means that there will be more large turboprops in Canada than in the US.

Scope clauses

Scope clause provisions are one aspect of regional operations in the US that could affect the potential market for a 90-seat turboprop *(see What type & size of aircraft does the US regional market require, Aircraft Commerce, February/March 2013, page 9).*

Scope clauses can restrict the size, type and number of aircraft that third-party regional carriers can operate under CPAs for a major airline. They therefore offer job security to mainline airline pilots by limiting the capacity that can be outsourced to regional carriers.

Previously, major US carrier scope clauses limited the maximum capacity of regional affiliate operations to 50-seat aircraft. This led to the growth in popularity of 50-seat RJs in the US market. High fuel prices over the past few years have encouraged more relaxed scope clauses, with aircraft of up 76 seats permitted to operate regional affiliate services.

Scope clauses that restrict aircraft capacity to 76 seats could impact the potential demand for a 90-seat turboprop. Mitchell, however, points out that scope clauses are not uniform across all airlines.

"First, turboprops are not always subject to scope clauses, explains Mitchell. "Scope clause restrictions can also vary by airline, and some airlines do not have scope clauses at all."

Moore also believes that there could be room for negotiation when it comes to large turboprops. "In the US market airlines are exiting the 50-seat RJ market due to rising operating costs," claims Moore. "The first priority for US carriers is to replace these with larger jets. Scope clauses will limit the ability to add large turboprops like the ATR72, but we believe there will be some space within scope clauses that will allow airlines to optimise and use turboprops on shorter routes where RJs are not as efficient or profitable."

North American routes

The number of routes considered suitable for a 90-seat turboprop in North America has declined over the past 10 years.

In 2005 there were 58 suitable routes. This had fallen to 38 routes by 2010, and to just 33 by 2015.

Some of this decline can be attributed to changes in scope clauses. The relaxation of scope clauses has led to a reduction in 50-seat RJ services in favour of larger RJs in configurations of up to 76 seats. This jump in average aircraft size has increased the average capacity to beyond 95 seats on some airport-pairs that were previously suitable for a 90-seat turboprop.

In 2015 there are 33 airport-pairs suitable for a 90-seat turboprop in the North American market, with an average capacity of 85-95 seats per flight and a sector length of less than 500nm.

TOP 20 SUITABLE ROUTES FOR A 90-SEAT TURBOPROP IN ASIA PACIFIC BASED ON TWO-WAY CAPACITY IN 2015

Airport Pair	Origin Country	Destination Country	Seats	Flights	Av Seats	Sector Length (nm)
Brisbane (BNE) - Rockhampton (ROK)	Australia	Australia	832,984	9,676	86	279
Osaka-Itami (ITM) - Matsuyama (MYJ)	Japan	Japan	796,665	8,760	91	148
Kumamoto (KMJ) - Osaka-Itami (ITM)	Japan	Japan	619,048	6,588	94	257
Jayapura (DJJ) - Wamena (WMX)	Indonesia	Indonesia	518,064	5,586	93	131
Mandalay (MDL) - Yangon (RGN)	Myanmar	Myanmar	474,154	5,353	89	301
Bangkok Don Mueang (DMK) - Nan (NNT)	Thailand	Thailand	458,160	4,836	95	292
Surabaya (SUB) - Semarang (SRG)	Indonesia	Indonesia	440,772	5,094	87	141
Chifeng (CIF) - Hohhot (HET)	China	China	431,744	4,818	90	344
Kinmen (KNH) - Taipei-Songsh (TSA)	Taiwan	Taiwan	392,100	4,158	94	179
Christchurch (CHC) - Queenstown (ZQN)	New Zealand	New Zealand	296,472	3,333	89	188
Dunedin (DUD) - Wellington (WLG)	New Zealand	New Zealand	286,128	3,042	94	341
Cebu (CEB) - Tacloban (TAC)	Philippines	Philippines	257,452	2,922	88	85
Bangkok Survarnabhumi (BKK) - Luang Prabang (LPQ)	Thailand	Laos	220,176	2,372	93	368
Manado (MDC) - Ternate (TTE)	Indonesia	Indonesia	206,426	2,360	87	154
Hohhot (HET) - Wuhai (WUA)	China	China	187,500	2,070	91	229
Hanoi (HAN) - Luang Prabang (LPQ)	Vietnam	Laos	143,336	1,676	86	221
Delhi (DEL) - Jodhpur (JDH)	India	India	139,340	1,465	95	257
Madang (MAG) - Port Moresby (POM)	Papua New Guinea	Papua New Guinea	138,160	1,454	95	267
Maumere (KOE) - Kupang (MOF)	Indonesia	Indonesia	129,180	1,368	94	124
Queenstown (ZQN) - Wellington (WLG)	New Zealand	New Zealand	122,668	1,295	95	347

Source: Innovata

Notes: Figures for each airport-pair include both directions of travel. Seat and av seat numbers are therefore based on two-way capacity.

The 33 routes will provide 18.7 million return seats across more than 210,000 flights in 2015. About half of the routes have a sector length of less than 300nm.

The largest of the 33 airport-pairs by capacity is Washington National (DCA) to New York La Guardia (LGA) *(see table, page 21)*.

The five largest of these airport-pairs will each support over one million two-way seats.

The top eight airport-pairs are all domestic US services. The largest domestic Canadian service is St Johns (YYZ) to Halifax (YHZ). All of the top 20 airport-pairs are either domestic US or domestic Canadian routes. None of them are international services between the US and Canada.

The largest origin airport among the 33 routes is Chicago O'Hare (ORD). It provides more than 1.5 million one-way seats on services to Cleveland (CLE), Detroit (DTW) and Pittsburgh (PIT) in 2015. The next largest origin airports are DTW and DCA. The largest Canadian origin airport is Calgary (YYC).

Many of the 33 routes are served by multiple airlines, using different aircraft types. One airline might use narrowbodies, while another uses RJs or turboprops. It is this mix of aircraft types that leads to an average capacity of 85-95 seats on most routes.

Some of the routes are served by a single major airline using both mainline and regional affiliate aircraft. On its Houston (IAH) to Austin (AUS) route United uses mainline 737 and A320 family aircraft, in addition to CRJ700s, E-170s and E-175s, and ERJ family aircraft, operated by regional affiliates. This results in an average capacity of 93 seats. The sector length on this airport-pair is only 121nm, so a 90-seat turboprop could potentially be the optimum operational platform.

One North American airline that does not envisage a demand for a larger turboprop is Canadian Q400 operator WestJet Encore.

"With our 78-seat Q400s, WestJet Encore has the size of aircraft that meets our airline and regional growth needs," explains Robert Palmer manager of public relations at WestJet Encore. "The Q400 NextGen turboprop is inherently flexible with four distinct variants. For now, our current configuration is doing the job for us."

Asia Pacific

Available seat capacity on routes of up to 500nm in length increased by 79% in the Asia Pacific region from 2005 to 2015.

In 2015 more than 726 million seats will be flown in the Asia Pacific on sectors of up to 500nm. The number of seats operated by narrowbodies, RJs and turboprops all increased on these sectors from 2005 to 2015. The strongest growth came from RJs. The number of seats operated by widebodies decreased over the same period.

The largest Asia Pacific origin markets for flights of up to 500nm are China and Japan.

Turboprops will provide more than 70 million two-way seats on routes of up to 500nm in 2015. About 89% of this turboprop capacity will be operated on sectors of 300nm or less.

The average capacity of turboprop services on airport-pairs of up to 500nm increased from 38 to 56 seats from 2005 to 2015. The percentage of turboprop capacity provided by ATR72s and Q400s increased during this period. The ATR72 provides the most capacity of any turboprop type in the Asia Pacific. There are 268 ATR72s and 96 Q400s in active passenger service in the Asia Pacific region in 2015.

The largest ATR72 operators in the Asia Pacific are Wings Air (39), Jet Airways (18), Firefly (17), Mount Cook Airline (17) and MASwings (14).

Firefly and MASwings are wholly-owned subsidiaries of Malaysian Airlines.

Wings Air is an Indonesian airline, Jet Airways is based in India and Mount Cook Airline is a wholly-owned subsidiary of Air New Zealand.

All of these operators have expanded their ATR72 fleets since 2010, and added the latest -600 variant in the past few years. MASwings seems to have replaced ageing Fokker 50s with ATR72-600s.

The largest Q400 operators are Sunstate Airlines (31), ANA Wings (21), SpiceJet (14) and Japan Air Commuter (11).

Sunstate Airlines is a subsidiary of Qantas. It operates under the QantasLink brand. ANA Wings and Japan Air Commuter are Japanese regional operators. SpiceJet is an Indian low-cost carrier (LCC).

In 2005, Sunstate Airlines operated five Q100/200s and eight Q300s. By 2010 it had replaced these with a fleet of 21 Q400s. Its Q400 fleet grew by a further 10 aircraft from 2010 to 2015.

The Q400 is the largest turboprop available. In 2014, Bombardier launched an extra capacity configuration of the Q400. This accommodates up to 86 seats.

Japan Air Commuter used Q400s to replace YS-11s. Its Q400 fleet has remained the same size since 2010.

Asia Pacific routes

The number of routes considered suitable for a 90-seat turboprop in the Asia Pacific remained relatively unchanged from 2005 to 2015. In 2005 there were 48 suitable routes, falling to 42 by 2010.

In 2015 there are 45 airport-pairs suitable for a 90-seat turboprop in the Asia Pacific, which have an average capacity of 85-95 seats and a sector lengths of up to 500nm.

The number of suitable routes for a 90-seat turboprop in the Asia Pacific increased from 2010 to 2015, but there was a decline in the number of frequencies and capacity operated over the qualifying airport-pairs.

In 2015 the 45 suitable routes will provide about 8.7 million seats over more than 96,000 flights. More than half of the routes have a sector length of 300nm or less.

The largest of the 45 airport-pairs by capacity is the domestic Australian service linking Brisbane (BNE) with Rockhampton (ROK) *(see table, page 22)*.

The four largest of these airport-pairs will each provide more than 500,000 two-way seats in 2015.

All but two of the top 20 airport-pairs are domestic services. In addition to BNE-ROK, this includes four domestic services in Indonesia, three in New Zealand, and two in China and Japan.

The largest international links are between Luang Praban (LPQ) in Laos and Bangkok (BKK) in Thailand, and LPQ to Hanoi (HAN) in Vietnam.

The predominance of domestic services among the top 20 airport-pairs could partly be attributed to the geography of the Asia Pacific region. There are some large countries and large distances between countries in the region, which in turn means that many routes below 500nm in length will be domestic.

The airport with the most originating capacity among the 45 routes is Osaka-Itami (ITM) in Japan. It will provide more than 700,000 one-way seats on domestic services to Kumamoto (KTM) and Matsuyama (MYJ) in 2015. The next largest origin airports by capacity are BNE, ROK and MYJ.

Many of the 45 routes have average capacities of 85-95 seats, because they are operated by different airlines with several aircraft types. An example is the Indonesian domestic service linking Surabaya (SUB) and Semarang (SRG). This airport-pair is operated by three different airlines. One operator uses 737s, ones uses CRJ1000s, and the third uses turboprops. The average aircraft size is 87 seats.

Some of the 45 routes are served by a single operator using multiple aircraft types. A 90-seat turboprop could help these airlines to optimise their operations. Air New Zealand uses a mixture of narrowbodies and turboprops on its domestic services between Christchurch (CHC), and Queenstown (ZQN), Dunedin (DUD), and Wellington (WLG).

There was at least one route being flown by a single operator with a single aircraft type.

AVISTAR used 87-seat BAE146s to serve the domestic Indonesian route between Yogyakarta (JOG) and Bandar Lampung (TKG).

A 90-seat turboprop would be more efficient than these four-engine RJs.

Summary

Turboprops can offer lower operating costs than RJs on short sectors.

The largest turboprops currently available are the ATR72 and the Q400. More than 75% of these aircraft are based in Europe, North America and the Asia Pacific.

There has been an increase in average capacity on turboprop services in these regions since 2005.

ATR and Bombardier are the most likely candidates to introduce a 90-seat turboprop, although neither has plans do to so in the near future. They have both explored ways to increase the capacity of their current aircraft.

ATR and P&WC both believe there could be a market for a 90-seat turboprop in the future. P&WC is already developing a new engine solution for a 90-seat aircraft.

An analysis of schedule data suggests that there are a number of routes for which a 90-seat turboprop could be the optimum operating platform.

In 2015 there are 188 airport-pairs across Europe, North America and the Asia Pacific, that have suitable sector lengths and average capacities for a 90-seat turboprop.

Europe is the largest potential market with 110 suitable routes. These will provide 20.4 million seats over 230,000 flights in 2015. Europe has also seen the most growth in suitable airport-pairs over the past five years.

There are 33 suitable airport-pairs in North America providing 18.7 million seats over 210,000 flights. The number of suitable routes in this region has been declining since 2005, however. Scope clauses could limit the potential for 90-seat turboprops in North America, and in particular in the US.

There are 45 suitable routes in the Asia Pacific region in 2015. These will provide about 8.7 million seats over 96,000 flights in 2015. The number of suitable routes has remained relatively stable in this region over the past 10 years. AC