

The size of regional aircraft operated in the US is influenced by scope clauses, passenger demand and operating costs. The number of larger RJs in operation has risen at the expense of 50-seat aircraft. Turboprop numbers have been in consistent decline in recent years.

What type & size of aircraft does the US regional market require?

The US domestic air transport market is one of the largest in the world. Since 2004, however, US domestic seat capacity, on all routes and in both directions, has fallen by more than 10% from 914 million seats to 815 million in 2012.

This 10% overall drop is accounted for by a 15% fall in the number of seats provided by mainline aircraft, and a 4% rise in those provided by regional aircraft. This shows that airlines are using more regional aircraft as they adjust capacity and combat rising fuel prices and eroded passenger yields.

Another development in the fleets of the major airlines' regional affiliates over the past 25-28 years has been the steady growth from 20- and 30-seat turboprops to larger, mainly 50-seat ones, the introduction of 35-seat and 50-seat regional jets (RJs), and the trend towards larger 70- and 90-seat RJs. Recent years have seen the introduction of mini jetliners, but many regional markets cannot justify RJs because they have short routes or low passenger demand.

This analysis will use fleet and route capacity data to identify the type and size of regional aircraft, whether turboprops or RJs, the US domestic market needs to serve its regional routes (see table, page 10). The largest aircraft to be considered under the regional banner are the E-195 and CRJ-1000. Small narrowbodies, like the 717, are classed as mainline aircraft.

Hub and spoke

The US market is dominated by a small number of major airlines that has consolidated with a series of mergers over

the past eight years, taking the number of major carriers down from eight to four. These are: Delta Air Lines, which merged with Northwest Airlines in 2008; United Airlines, which merged with Continental Airlines in 2011; and US Airways which merged with America West in 2005. US Airways is merging with American Airlines under the latter's brand, so there will be just three major airline groups in the US in the near future. These majors will be joined by Alaska Airlines, the fourth largest legacy carrier in the US.

The mergers have also significantly reduced domestic capacity (see *US legacy airlines & LCCs attain stable profitable performance, Aircraft Commerce, December 2012/January 2013, page 5*).

All major airlines operate a hub-and-spoke strategy. Regional aircraft are used to serve peripheral locations from the major hubs, and provide the major airline with feeder traffic for onward connections. Regional aircraft are generally operated by regional partner carriers under a major airline's regional brand, by way of capacity purchase agreements. The majors' regional brands are Delta Connection, United Express, US Airways Express, and American Eagle.

There are a significant number of regional aircraft operators in the US (see table, page 10). Some are part of a larger group or holding company, for example. This category includes wholly owned subsidiaries of major airlines, such as: American Eagle, which is owned by American Airlines; PSA and Piedmont Airlines, which are owned by US Airways Group; and Horizon Air, which is part of Alaska Air Group.

Some of the largest regional operators

are part of holding companies that own multiple carriers, independent from the majors. The largest of these is SkyWest Inc, which owns SkyWest Airlines and ExpressJet Airlines, with a combined fleet of nearly 750 regional aircraft. Republic Holdings owns Chautauqua Airlines, Republic Airlines and Shuttle America, with a combined fleet of nearly 200 aircraft. Another group is Trans States Holdings, which owns Compass Air, GoJet Airlines and Trans States Airlines, with a combined fleet of 109 aircraft.

A number of other significant regional carriers are neither major airline subsidiaries nor part of a collective group. These include Pinnacle Airlines, Mesa Airlines, Air Wisconsin, CommutAir, Great Lakes Airlines and Silver Airways.

Scope clauses

Any attempt to identify the optimum type and size of aircraft for the US regional market needs to consider pilot labour agreements, particularly scope clause provisions on composition and development of regional aircraft fleets.

"A scope clause sets out the work that an airline's pilots can do," says an Airline Pilots Association (ALPA) spokesperson. "The basic proposition is that all flying is done by the pilots on an airline's seniority list, but other clauses can relate to regional aircraft. They can specify the number, type and size of regional aircraft that regional affiliate carriers can operate under the major airline's brand."

Scope clauses provide job security for mainline pilots by limiting the capacity and volume of a major's operation that can be outsourced to regional partners.

MAIN REGIONAL OPERATORS IN THE US

Airline	Group	Fleet Size	RJs	Turboprops	Mainline Partners
ExpressJet Airlines	SkyWest Inc	418	418	0	Delta, United, American (fr 2013)
SkyWest Airlines	SkyWest Inc	321	279	42	Delta, United, US Airways, Alaska
American Eagle	AMR	245	245	0	American
Pinnacle Airlines		195	195	0	Delta
Republic Airlines	Republic Holdings	86	71	15	United, US Airways
Air Wisconsin		71	71	0	US Airways
Chautauqua Airlines	Republic Holdings	70	70	0	American, Delta, United, US Airways
Shuttle America	Republic Holdings	67	67	0	Delta, United
Mesa Airlines		61	61	0	United, US Airways
PSA Airlines	US Airways Group	49	49	0	US Airways
Horizon Air	Alaska	48	0	48	Alaska
GoJet Airlines	Trans States Holdings	45	45	0	Delta, United
Piedmont Airlines	US Airways Group	43	0	43	US Airways
Compass Air	Trans States Holdings	42	42	0	Delta
Silver Airways Corp		35	0	35	United
Great Lakes		34	0	34	United
Trans States Airlines	Trans States Holdings	22	22	0	United, US Airways
CommutAir		21	0	21	United
Executive Airlines	AMR	9	0	9	American
Total		1,882	1,635	247	

“Each major airline has different scope clauses with varying restrictions in terms of regional flying,” explains the ALPA spokesperson. “Mainline pilots realise that certain services and routes are more economically served by regional aircraft operated by regional affiliate carriers, which have lower pilot salary scales than the majors. Initially, scope restrictions limited mainline carriers to contracting their regional affiliates to using all types of regional aircraft with a capacity of no more than 50 seats. However, significant rises in the cost of fuel and other market changes have hurt the economic viability of the 50-seat RJ, so new, more liberal scope restrictions are beginning to permit the use of larger regional aircraft.”

One of the largest operators of regional aircraft in the US feels that scope clause restrictions have influenced the fleet’s development. “Scope restrictions are the key driver determining the size of regional aircraft operated,” says Chip Childs, president and chief operating officer at SkyWest Airlines. “Passenger demand on each route also plays a role in fleet planning, and points to a need for more large RJs from 70-90 seats, which are limited by scope clauses.”

Aircraft manufacturers agree that scope clauses have had an impact. “Scope clauses have been one of the biggest influences on the regional market, because they impose artificial limits on airlines’ fleet planning strategies,” says Filippo Bagnato, chief executive officer at French-Italian aircraft manufacturer ATR. “They limit the size of aircraft that can be operated by the regional partners. Limits can be imposed based on aircraft

maximum takeoff weight (MTOW), or seat capacity. They often limit the number of a specific size of aircraft that can be operated. These artificial limits create a different set of challenges for airlines and manufacturers alike. When you cannot have the optimum number of seats in a certain type, it is even more important to ensure it has the most efficient features.”

“US regional affiliates were restricted to using aircraft with an upper size limit of 50 seats,” says Paulo Cesar Silva, president of commercial aviation at Brazilian aircraft manufacturer Embraer. “As a result, a huge number of aircraft were manufactured in this size category. More recently a second wave of larger RJs has followed negotiations between some major airlines and pilots’ unions to get scope relief for the use of up to 76-seat aircraft in their regional affiliates.”

The relief in aircraft size restrictions is not straightforward. “Scope clauses have evolved to permit airlines to operate larger-capacity regional aircraft that will ease the transition from uneconomic 50-seat RJs,” says Bagnato. “The downside is that there are caps on the total number of larger regional aircraft that can be operated on behalf of the major airlines. This will limit the market’s potential.”

This is shown by a recent order for CRJ-900s to be operated under the Delta Connection brand. “Delta negotiated a capacity-neutral solution, whereby the arrival of the new 76-seat aircraft will lead to the removal of 50-seaters from Delta Connection’s contracted fleet,” says Philippe Poutissou, vice president of marketing at Bombardier. “Only 70 76-seat aircraft are currently allowed to fly under Delta Connection’s brand.”

Regional capacity

This analysis will focus on domestic services flown by regional aircraft from the 21 US domestic hubs operated by Delta, United, American and US Airways.

Delta has hubs at Atlanta (ATL), Cincinnati (CVG), Detroit (DTW), Memphis (MEM), Minneapolis (MSP), New York (JFK), New York La Guardia (LGA) and Salt Lake City (SLC). Delta Connection flights are operated to and from these hubs by Chautauqua Airlines, Compass Airlines, ExpressJet Airlines, GoJet Airlines, Pinnacle Airlines, Shuttle America and SkyWest Airlines.

United has hubs at Chicago (ORD), Cleveland (CLE), Denver (DEN), Houston (IAH), Los Angeles (LAX), Newark (EWR), JFK, San Francisco (SFO) and Washington Dulles (IAD). United Express services are operated by Chautauqua Airlines, CommutAir, ExpressJet Airlines, GoJet Airlines, Great Lakes Airlines, Mesa Airlines, Republic Airlines, Silver Airways, Shuttle America, SkyWest Airlines and Trans States Airlines.

American has hubs at Dallas (DFW), Miami (MIA), JFK, LAX, and ORD. Regional services are operated by Chautauqua Airlines under the American Connection brand, American Eagle operating its own flights, and ExpressJet Airlines and Republic Airlines under the American Eagle brand following recently announced capacity purchase agreements.

US Airways has hubs at Charlotte (CLT), Philadelphia (PHL) and Phoenix (PHX). US Airways Express services are operated by Air Wisconsin, Chautauqua Airlines, Mesa Airlines, Piedmont

US REGIONAL AIRCRAFT ACTIVE FLEET 1993 - 2013

Aircraft Type	1993	1998	2003	2008	2013
19-21 Seat Turboprop	825	618	397	284	202
29-36 Seat Turboprop	617	759	599	338	194
45-50 Seat Turboprop	195	115	61	19	32
65-80 Seat Turboprop	39	81	85	99	73
Total turboprops	1,676	1,573	1,142	740	501
30-35 Seat RJ	0	0	118	103	32
45-50 Seat RJ	0	113	833	1,251	1,031
70-80 Seat RJ	80	41	109	328	431
90+ Seat RJ	86	132	78	133	222
Total RJs	166	286	1,138	1,815	1,716

Airlines, PSA Airlines, Republic Airlines, SkyWest Airlines and Trans States Airlines.

Turboprop fleet & capacity

An analysis of aircraft in a passenger configuration shows that the turboprop fleet in service with US operators has been in constant decline over the past 20 years (see table, this page).

In 1993 there were 1,676 turboprops with 19 seats or more, flying for US airlines, but by 2012 there were only 500 (see table, this page); a reduction of 70%.

“One reason for the reduction in the number of turboprops is passengers’ preference for jets, especially because of their comfort levels,” says Silva. “RJs also have higher seat-mile productivity and operational efficiency for mid- to long-haul regional flights,” adds Silva.

The US’s geography and the distances between some destinations do not help the turboprop cause. “On stage lengths beyond 350 nautical miles (nm), the RJ’s productivity outweighs the economics of the turboprop,” explains Poutissou.

The size of turboprops has also changed over the past 20 years. In 1993 the most common type was the 19-seat Jetstream 31 (J31), with nearly 250 in service. Other 19-seaters, like the Beech 1900 and variants of the Metroliner, also had more than 200 aircraft in operation.

The next most popular size bracket was the 29-36-seat category. Just under 200 EMB-120s and about 190 Saab 340s were in operation, and a significant number of Dash 8-100s and SD360s. The ATR 42 dominated the 45-seat bracket, with more than 100 in service.

There has been a large fall in the number of smaller and older turboprops. The 19-21-seat fleet declined by 75%, the 29-36-seat fleet by 69%, and the 45-50-seat fleet by 84%. The 65-80-seat fleet grew by 87% from 1993, although it has declined in the past five years.

The 19-seat Beech 1900, however, is the most common regional feeder

turboprop in service, while Bombardier is now the dominant turboprop manufacturer in the US market, with nearly 150 Dash 8s in service. The 70-seat Q400 is the most numerous, with more than 60 in operation. This highlights the shift to larger turboprops.

The ATR fleet has declined from more than 150 aircraft in the mid-1990s to only 13 ATR 42s and ATR 72s.

Horizon Air, Piedmont Airlines and SkyWest Airlines have the largest turboprop fleets. Horizon has an all-Q400 fleet, while Piedmont operates a mix of Dash 8-100s and -300s. SkyWest still operates the EMB-120. Other turboprop operators include smaller airlines: Silver Airways, Great Lakes Airlines, CommutAir, Republic Airlines and Executive Airlines.

A review of departing passenger capacity, on a one-way basis, across all routes and across the 21 hub airports analysed for 2004-2012 reveals that the number of turboprop operations and seat-mile capacity declined by 46% and 39% respectively. The average aircraft size on turboprop-operated services increased from 34 to 38 seats over the same period.

This clearly illustrates the decline in the use of turboprops, and the fact that the remaining aircraft are becoming larger.

The Dash 8 series accounted for more than 60% of turboprop seat capacity, making it the most dominant turboprop. The Q400 represented the largest growth in capacity by a turboprop since 2004.

Large cuts in capacity were provided by smaller turboprops such as the Saab 340, EMB-120 and Beech 1900. The J31 and J41 contributed no capacity in 2012.

Cost efficiency

Despite a decline in turboprop numbers, ATR and Bombardier believe they have a future on short-sector routes in the US. “Taking into account rising fuel costs, it is only natural that airlines

will see the benefits of turboprops on shorter routes where they provide lower costs per seat-mile,” says Bagnato. “The 70-seat turboprop has become the reference for regional routes up to 400 miles.”

The average turboprop route length, across the 21 US hubs, ranges from 125nm at MEM to 263nm at DEN.

An analysis of turboprop capacity by each airline group across these hubs gives an insight into fleet planning trends.

United

United was the only one of the four major airlines to increase turboprop capacity during 2004-2012. In 2012 the recently combined United/Continental network provided the most turboprop capacity by a major carrier, with more than 4.3 million seats, a rise of 35% since 2004. The average turboprop size increased from 29 to 41 seats, with the Q400 contributing to this.

Of the 21 hubs under analysis, only six demonstrated a growth in turboprop capacity. Five of these (EWR, IAH, CLE, IAD and SFO) are United hubs.

EWR had the largest growth, and the number of seats increased by more than 930,000 to 2012. Most were supplied by Dash 8-200s/300s and Q400s, and the average turboprop size increased from 29 to 50 seats. The increase in turboprop capacity has come at the expense of smaller RJ services on shorter routes. Most routes are 85nm to 260nm.

Increased turboprop capacity at IAH, CLE, IAD and SFO was mainly generated by United Express affiliates. Each of these hubs also saw an increase in average turboprop size, as a result of more flights being operated by the larger Q400.

US Airways

US Airways provided the second-highest turboprop capacity. In 2012 more than 2.6 million seats were available on US Airways-marketed services. Most

were provided by Piedmont Airlines, using a mix of Dash 8-100s and -300s.

Turboprop-operated capacity has nevertheless reduced by 38% since 2004, when America West's capacity from 2004 is taken into consideration. Average turboprop size increased from 37 to 41 seats, as capacity from smaller turboprops was withdrawn.

US Airways was the only other major that experienced turboprop capacity growth. Its Philadelphia base provided more than 1.3 million seats in 2012.

There are several routes, of no more than 260nm, from Philadelphia where turboprop capacity has grown, and small RJ capacity has reduced, but there are no examples of turboprop capacity replacing RJ seats from Charlotte or Phoenix hubs.

Charlotte had the most seats provided by turboprops in 2004, but this number had been halved by 2012, due to the phasing-out the Do328, and a reduction in Dash 8-100/-300 operations.

Phoenix also saw a 70% reduction in turboprop capacity to less than 100,000 in 2012. The majority of capacity had been provided by Air Midwest and Mesa Airlines. Mesa Airlines's Dash 8-100 services were heavily cut, while Great Lakes Airlines increased its independent capacity using Beech 1900s. This resulted in average seat size falling from 30 to 27.

American Airlines

American Airlines provided the third largest turboprop capacity in 2012. Just over 250,000 departing seats represented a cut of 83% from 2004 levels. Average aircraft size rose from 33 to 65 seats, due to the phasing-out of smaller aircraft, like the Saab 340, in favour of exclusive turboprop operations using Executive Airlines' ATR72s.

With the exception of ORD, all of American Airlines' hubs have seen a reduction in turboprop services. The airline did not have any marketed turboprop services from ORD or JFK during 2004-2012.

American Airlines removed all turboprop services from LAX, where American Eagle operated with Saab 340s.

This contributed to a 48% decline in total turboprop capacity from LAX during 2004-2012. United Airlines and Alaska Airlines are now the main providers of turboprop capacity from LAX, from their regional partners SkyWest Airlines and Horizon Air.

American Airlines still has turboprop capacity at DFW and MIA, but both experienced large capacity reductions.

DFW saw an 80% reduction. American Eagle Saab 340s were replaced with a smaller number of ATR72

provided by Executive Airlines.

MIA saw the number of turboprop seats decline by 60% to 170,000. American Eagle ATR 72 services were replaced with fewer Executive Airlines ATR72 flights. MIA's average turboprop size increased from 35 to 61 seats.

Delta Airlines

Delta has had the largest fall in turboprop capacity of all majors, with seat numbers down by 95% from the 4.3 million provided by Delta and Northwest in 2004. Delta now only operates turboprop services from SLC, and the number of turboprop seats has fallen by 65%. SkyWest has provided capacity with EMB-120s since 2004, accounting for all of Delta's turboprop capacity.

Delta had previously operated a mix of turboprops, including ATR72s, so average size has declined from 40 to 30 seats.

Delta is the only major with no turboprop services at some of its hubs in 2012, having withdrawn these from ATL, CVG, DTW, JFK, LGA, MEM and MSP since 2004. Many operations with Saab 340s and ATR72s have been phased out.

Many other airlines at MEM, MSP, CVG and LGA have also had large reductions in turboprop operations.



RJ fleet trends

The number of RJs with US operators has risen over the past 20 years. In 1993 there were only 166 RJs in service (see table, page 11), rising to 286 by 1998. The highest growth occurred from 1998 to 2003, when the number of active RJs increased by nearly 300% to more than 1,100. There was a further increase of nearly 70% during 2003-2008 with 1,815 aircraft in operation. RJ numbers fell by about 100 from 2008 to 2013.

There have been clear developments in the size of RJs used in the US. In 1993 the most common types were 100-seaters, like the Fokker 100 and BAe 146-200. These were operated in small numbers.

The 50-seat RJs, such as the CRJ-100 and -200 and the ERJ-145s, emerged in 1998. There was a sharp rise in the number of 50-seat RJs during 1998-2003. By 2003 CRJ-100/-200s were the most common regional aircraft, with nearly 450 in service. There were also 360 ERJ-140/-145s in operation. The number of 50-seat RJs continued to grow to 2008. CRJ-100/-200 numbers reached 600, and there were more than 570 ERJ-140/-145s.

50-seat RJs still comprise more than half the RJ fleet in the US in 2013, even though numbers have fallen since 2008. Active CRJ-100/-200s have reduced by

more than 25%, while the number of ERJ-140s/-145s has fallen by 10%.

This corresponds with a 150% increase in the number of parked RJs to 174 in 2013. More than 86% of these parked aircraft are 30-50-seaters, suggesting that operators have begun parking smaller RJs in the wake of rising fuel prices.

Relaxations in scope clauses relating to aircraft size have had an impact on the RJ fleet. As smaller RJs have phased out, the number of larger aircraft has risen. The number of E-170s/-175s/-190s and CRJ-700s/-900s, continues to grow. These aircraft accounted for nearly 40% of the RJ fleet at the beginning of 2013.

ExpressJet is the largest RJ operator. Its fleet of 418 aircraft consists mainly of ERJ-145s, CRJ-200s/-700s/-900s.

SkyWest Airlines has a fleet of 279 RJs consisting of CRJ-200s/-700s/-900s.

American Eagle and Pinnacle also have more than 100 RJs in service.

RJ capacity trends

An analysis of one-way RJ capacity, for all routes across the 21 hubs shows that it was more than 98.5 million seats in 2012, an increase of 25% since 2004.

The ERJ-140/-145 series provided the most capacity, with more than 26.2 seats.

Despite aircraft being withdrawn from service, there has still been an increase of more than 20% in capacity since 2004.

The CRJ-100/-200 series provided the second largest RJ capacity in 2012, with just over 26 million seats. This was more than 30% down on 2004 levels, further evidence of a decline in 50-seat RJs.

The growing deployment of larger RJs is highlighted by the aircraft providing the next five largest amounts of capacity being in the 70-seat and larger category. The CRJ-700 accounted for 17.7 million seats, the CRJ-900 more than 11.5 million, and the E-170, -175 and -190 for a combined 16.2 million. All the larger RJs have seen sizeable increases in capacity since 2004.

Older aircraft saw a significant fall. The ERJ-135 provided 760,000 seats in 2012, down by 69% from 2004.

The Avro RJ, BAe 146 and Fokker 100 have all been phased out since 2012.

The average routes operated by RJs serving the 21 hubs ranged in length from 390nm at CLT to 630nm at MIA.

Delta

Delta provided the most RJ capacity from the 21 hubs in 2012, with more than 34 million departing seats; 15% more than Delta's and Northwest's 30



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DEPARTING ONE-WAY REGIONAL AIRCRAFT CAPACITY ACROSS US HUBS 2004 - 2012

HUB	2004			2012			CHANGE		
	SEATS	FLIGHTS	AV SEATS	SEATS	FLIGHTS	AV SEATS	SEATS	FLIGHTS	AV SEATS
Atlanta Turboprops	1,532,666	23,668	65	51,711	3,057	17	-96.6%	-87.1%	-48
Atlanta RJs	6,345,032	117,129	54	7,517,576	131,645	57	18.5%	12.4%	3
Charlotte Turboprops	1,746,153	42,280	41	878,936	19,406	45	-49.7%	-54.1%	4
Charlotte RJs	2,730,685	53,568	51	8,077,025	128,844	63	195.8%	140.5%	12
Chicago (ORD) Turboprops				14,954	1,582	9			
Chicago (ORD) RJs	11,089,632	201,210	55	13,404,421	245,173	55	20.9%	21.8%	0
Cincinnati Turboprops	110,123	4,032	27	11,618	314	37	-89.4%	-92.2%	10
Cincinnati RJs	8,151,388	165,351	49	2,466,646	44,537	55	-69.7%	-73.1%	6
Cleveland Turboprops	260,398	12,141	21	465,719	13,361	35	78.8%	10.0%	14
Cleveland RJs	3,145,190	65,224	48	2,467,677	47,231	52	-21.5%	-27.6%	4
Dallas (DFW) TurboProps	636,169	22,515	28	127,070	1,876	68	-80.0%	-91.7%	40
Dallas (DFW) RJs	6,698,504	129,570	52	5,474,900	107,336	51	-18.3%	-17.2%	-1
Denver Turboprops	1,102,646	43,767	25	864,529	29,610	29	-21.6%	-32.3%	4
Denver RJs	3,160,258	53,801	59	5,737,871	93,206	62	81.6%	73.2%	3
Detroit Turboprops	848,502	24,961	34				-100.0%	-100.0%	
Detroit RJs	3,434,379	64,996	53	7,147,674	127,332	56	108.1%	95.9%	3
Houston Turboprops	334,290	11,143	30	611,012	11,898	51	82.8%	6.8%	21
Houston RJs	4,232,993	86,013	49	5,566,116	103,097	54	31.5%	19.9%	5
Los Angeles Turboprops	1,551,210	51,451	30	806,426	23,081	35	-48.0%	-55.1%	5
Los Angeles RJs	1,254,070	24,169	52	3,126,446	54,283	58	149.3%	124.6%	6
Memphis Turboprops	403,910	12,015	34	17,205	1,891	9	-95.7%	-84.3%	-25
Memphis RJs	2,676,493	50,940	53	2,371,887	42,576	56	-11.4%	-16.4%	3
Miami Turboprops	440,979	12,498	35	168,880	2,775	61	-61.7%	-77.8%	26
Miami RJs	244,444	5,326	46	899,575	17,484	51	268.0%	228.3%	5
Minneapolis Turboprops	974,792	29,032	34	109,442	5,499	20	-88.8%	-81.1%	-14
Minneapolis RJs	3,239,081	58,420	55	5,937,227	95,440	62	83.3%	63.4%	7
New York (JFK) Turboprops	20,242	698	29				-100.0%	-100.0%	
New York (JFK) RJs	1,016,647	21,581	47	3,203,497	45,147	71	215.1%	109.2%	24
New York (LGA) Turboprops	1,038,481	30,879	34	314,325	8,412	37	-69.7%	-72.8%	3
New York (LGA) RJs	2,690,592	58,401	46	5,430,603	85,916	63	101.8%	47.1%	17
New York (EWR) Turboprops	11,571	399	29	931,033	18,506	50	7946.3%	4538.1%	21
New York (EWR) RJs	3,507,666	70,768	50	3,269,197	58,792	56	-6.8%	-16.9%	6
Philadelphia Turboprops	1,082,001	29,492	37	1,349,539	34,701	39	24.7%	17.7%	2
Philadelphia RJs	2,651,377	51,001	52	5,448,805	86,156	63	105.5%	68.9%	11
Phoenix Turboprops	324,075	10,911	30	95,455	3,601	27	-70.5%	-67.0%	-3
Phoenix RJs	2,346,280	36,434	64	2,293,102	36,518	63	-2.3%	0.2%	-1
Salt Lake City Turboprops	620,300	21,306	29	215,636	7,006	31	-65.2%	-67.1%	2
Salt Lake City RJs	3,193,876	62,293	51	3,588,547	58,265	62	12.4%	-6.5%	11
San Francisco Turboprops	527,370	17,579	30	762,160	23,780	32	44.5%	35.3%	2
San Francisco RJs	1,070,490	20,941	51	1,832,831	31,216	59	71.2%	49.1%	8
Washington (IAD) Turboprops	505,670	17,213	29	763,788	16,559	46	51.0%	-3.8%	17
Washington (IAD) RJs	5,812,221	114,985	51	3,391,556	58,734	58	-41.6%	-48.9%	7

SHORT SECTOR FUEL BURN COMPARISON OF REGIONAL AIRCRAFT

Route	Aircraft type	Available payload (lbs)	Passenger payload (seats)	Tracked distance (nm)	ESAD (nm)	Wind (kts)	Block Time (hr:min)	Block fuel (USG)	Fuel burn USG per seat-mile
EWR-ALB	ATR72-500	16,203	65	151	161	-14	01:06	205	0.0196
	S340B	8,555	34	151	163	-18	01:01	121	0.0218
	Q400	18,014	74	151	156	-8	00:57	264	0.0229
	ATR42-500	12,015	48	151	164	-18	01:06	180	0.0229
	E-190-100AR	28,867	99	151	167	-37	00:48	431	0.0261
	CRJ-200LR	13,100	50	151	165	-33	00:48	221	0.0268
	CRJ-700	21,005	70	151	168	-39	00:48	321	0.0273
	EMB-120	7,319	30	151	155	-6	01:01	130	0.0280
	CRJ900	21,840	77	151	167	-35	00:50	363	0.0283
	E-175	22,223	78	151	162	-25	00:49	379	0.0300
ERJ-140	12,560	44	151	169	-37	00:52	223	0.0300	
EWR-ROC	ATR72-500	16,203	65	221	249	-26	01:29	276	0.0170
	Q400	18,014	74	221	241	-23	01:16	341	0.0191
	S340B	8,555	34	221	245	-24	01:24	171	0.0206
	ATR42-500	12,015	48	221	246	-23	01:29	252	0.0213
	EMB-120	7,319	30	221	243	-23	01:22	178	0.0244
	E190-100AR	28,867	99	221	236	-22	01:06	593	0.0254
	CRJ-200LR	13,100	50	221	238	-23	01:07	306	0.0257
	CRJ-700	21,005	70	221	236	-22	01:06	445	0.0269
	CRJ-900	21,840	77	221	237	-23	01:06	495	0.0271
	E-175	22,223	78	221	238	-23	01:07	505	0.0272
ERJ-140	14,533	44	221	238	-23	01:09	332	0.0317	
EWR-PIT	ATR72-500	16,203	65	281	314	-25	01:44	326	0.0160
	Q400	18,014	74	281	308	-25	01:29	415	0.0182
	S340B	8,555	34	281	313	-26	01:38	199	0.0187
	ATR42-500	12,015	48	281	318	-28	01:44	285	0.0187
	E-190-100AR	28,867	99	281	308	-36	01:08	660	0.0216
	EMB-120	7,319	30	281	312	-25	01:37	211	0.0225
	CRJ-900	21,840	77	281	309	-36	01:10	543	0.0228
	CRJ-200LR	13,100	50	281	309	-36	01:09	353	0.0229
	CRJ-700	21,005	70	281	308	-35	01:09	493	0.0229
	E-175	22,223	78	281	309	-36	01:10	569	0.0236
ERJ-140	14,533	44	281	312	-36	01:15	358	0.0261	

Summary:

The above table demonstrates how turboprops can be more fuel-efficient than RJs over short sectors. The ATR72-500 demonstrates the lowest fuel burn per seat-mile across all three routes. On each city-pair the turboprops burn less fuel per seat-mile than RJs of a comparable size.

Notes:

Main assumptions for performance flight plans included: international flight rules, average temperatures for June, 85% reliability winds, standard assumptions for fuel reserves, diversion fuel and contingency fuel data. Optimum routes and flight levels based on shortest flight time were used. All airways rules and restrictions were complied with. Taxi time of 20 minutes per sector assumed. Performance based on maximum structural payload and LRC. Assumed maximum seats based on average size from US 2012 capacity data where possible. Seat miles calculated using ESAD.

million seats in 2004. The number of RJ flights declined by 3%, however. Delta's average RJ size has since increased from 52 to 60 seats.

The largest operators of Delta Connection RJ services in 2012 were Pinnacle Airlines with CRJ-100/-200s and CRJ-900s, and ExpressJet and SkyWest with CRJ-100/200s, CRJ-700s and CRJ-900s.

RJ capacity growth was positive at all of Delta's eight hubs, with the exception of CVG and MEM which lost 70% and 11% of seats respectively, and also saw falls in turboprop and mainline services. This suggests that this is part of a wider capacity-withdrawal strategy by Delta

since its merger with Northwest.

DTW and LGA both doubled their RJ capacity to 2012, mainly due to large increases in service by Delta Connection carriers. Pinnacle Airlines was the largest provider at DTW, using a mix of CRJ-100/-200s and CRJ-900s.

Shuttle America provided the most Delta Connection RJ capacity at LGA, using E-170s and E-175s. Average RJ size increased from 53 to 56 seats at DTW, and from 46 to 63 seats at LGA to 2012.

MSP also had a large increase in RJ capacity of 83%, with just under six million seats in 2012. Pinnacle Airlines provided the most seats using CRJ-100/200s and -900s. Compass Airlines

with E-170s and E-175s and SkyWest with CRJ-100/-200s, CRJ-700s and CRJ-900s also accounted for a significant amount of RJ capacity. Average RJ seat size increased from 55 to 62 at MSP.

At ATL and SLC, RJ capacity increased by 18.5% and 12.4% respectively to 2012.

ATL processed 7.5 million departing seats on RJs, mainly due to more Delta Connection services. Most were operated by ExpressJet with CRJ-100/-200s, CRJ-700s and CRJ-900s, resulting in a small rise in average aircraft size to 57 seats.

Delta Connection and United Express increased its RJ operations at SLC. Both used SkyWest Airlines CRJ-100/-200s



and CRJ-700s. SkyWest also has CRJ-900s. Average RJ size rose from 51 seats to 62.

RJ capacity increased on routes where turboprop or mainline capacity has been reduced at all of Delta's hubs where it is the sole operator. For example, in 2004 DTW-South Bend (SBN) had 98,000 seats: 56,000 provided by CRJ-100/-200s; and 42,000 by Saab 340s. By 2012, all turboprops had been withdrawn and RJ capacity had risen to 87,000 seats.

Replacement of mainline-operated services with RJs can be shown with DTW-Bradley International (BDL). In 2004 this route was operated entirely by Northwest Airlines' DC-9s, A319s and A320s which provided about 200,000 seats. By 2012 the capacity provided by mainline aircraft had fallen to 67,000 seats, while another 100,000 were available on RJ-operated flights. These were all flown on behalf of Delta Connection, with most seats provided by larger RJs such as E-170s, E-175s, CRJ-700s and CRJ-900s.

This suggests that as scope restrictions relating to the size of permitted RJs have been relaxed, airlines have downsized from mainline operations to 70-seat RJs where the level of demand may not warrant a 120-150 seat aircraft.

United

The second largest provider of RJ capacity in 2012 was United. The newly merged United/Continental operation accounted for just under 30 million seats of RJ capacity, a 23% increase on combined United and Continental RJ

services in 2004.

Average RJ size across the combined networks rose by four seats to 55, due to increased use of types such as the CRJ-700 and E-170. The largest operators of United Express RJ services were ExpressJet with ERJ-140/-145s and CRJ-100/-200s, SkyWest with CRJ-100/-200s and CRJ-700s and Shuttle America with E-170s. RJ capacity grew at the airline's DEN, SFO and IAH hubs.

DEN saw an 81% increase in RJ capacity, mostly as a result of growth by United Express affiliates. These were SkyWest with CRJ-100/-200s and CRJ-700s and ExpressJet with ERJ-140/-145s. Average aircraft size on RJ routes from DEN increased from 59 to 62 seats.

RJ capacity at SFO and IAH grew by 71% and 32%. Increased services by United Express accounted for a lot of this growth. Average RJ size rose by eight seats to 59 at SFO, and by five to 54 at IAH.

There was, however, a reduction in capacity by United at EWR, CLE and IAD. United Express was the largest contributor. All three hubs also saw a growth in turboprop services.

IAD RJ capacity fell by 41%. Despite a reduction in RJ capacity, average aircraft size on RJ services from EWR, CLE and IAD increased.

There were routes on United's network where RJ capacity increased at the expense of turboprop capacity, while EWR and SFO were United's only hubs that had no routes where turboprop capacity fell and RJ capacity increased.

RJ capacity did grow at the expense of mainline jet capacity on certain routes

Turboprop numbers have been in decline in the US over the past 20 years. Bombardier is currently the dominant turboprop manufacturer in the US market through its Dash 8 family of aircraft.

at United's hubs. For example, at IAH-DTW in 2004 there were 417,000 seats, all provided by Northwest A319s and A320s, and Continental 737s. By 2012 seat numbers had fallen to 250,000; 170,000 of these supplied by RJs. Most of this was provided by E-170s, CRJ-700s and CRJ-900s on behalf of United Express.

US Airways

US Airways was the third largest provider of RJ capacity in 2012, and had the highest growth in RJ seats during 2004-2012.

Before the US Airways and America West merger, their combined RJ seat capacity was about 8.3 million. This had almost doubled to 16.2 million by 2012. Average aircraft size on RJ services across the combined network increased from 56 to 64 seats during the same period.

The largest operators of US Airways Express services in 2012 were: Republic Airlines with E-170, E-175 and E-190s; Mesa Airlines with CRJ-100/-200s and CRJ-900s; Air Wisconsin, with CRJ-100/-200s; and PSA Airlines, with CRJ-100/-200s and CRJ-700s.

CLT is US Airways' largest hub in terms of RJ seats. In 2012 it provided over eight million such seats, a near trebling of 2004 capacity. Main operators are PSA with CRJ-100/-200s and CRJ-700s, and Mesa with CRJ-900s.

PHL saw a near doubling of RJ seat capacity, with numbers increasing to 5.4 million in 2012. Extra services from US Airways Express were provided. Most were operated by Republic Airlines with E-170s, E-175s and E-190s, and Air Wisconsin with CRJ-100/-200s. Average aircraft size increased by 11 seats to 63.

PHX, US Airways' third hub, saw a decline in RJ seats by 2.1% to 2012. US Airways' Express RJ flights at PHX were operated by Mesa with CRJ-100/-200s and CRJ-900s, and SkyWest with CRJ-100/-200s.

There were many examples of RJ capacity increasing at the expense of turboprop seats from US Airways hubs. There are also examples of RJ capacity supplanting mainline seats on certain routes. Republic Airlines E-175s, Mesa CRJ-900s and PSA CRJ-700s made up most seats provided on many routes.

There were about 1,700 RJs in service with US regional carriers at the start of 2013. Smaller 40-50 seat RJs are beginning to be replaced by 70-80 seat aircraft, such as the Embraer E-Jets.

American Airlines

American Airlines provided the least RJ capacity across the 21 hubs in 2012 of the four majors, but this still rose by 28% to 2012. Average aircraft size on its RJ services decreased by two seats to 50, partly due to the withdrawal of the larger Fokker 100s on regional routes.

American Airlines' RJ capacity was provided by American Eagle using CRJ-700s, ERJ-140/-145s and ERJ-135s, Chautauqua Airlines with ERJ-140/145s, and SkyWest with CRJ-100/200s.

MIA had the largest growth in RJ capacity, although its capacity was small in 2004. By 2012 this had almost trebled to just under 900,000 seats, mainly due to a large jump in American Eagle ERJ-140/-145 operations.

American Eagle also increased its RJ capacity at DFW with ERJ-135s, ERJ-140/-145s and CRJ-700s.

JFK had the largest overall growth in RJ capacity, and seat numbers trebled to more than three million. Average capacity of RJ-operated flights rose from 47 seats to 71, partly due to American Eagle's greater use of larger aircraft, including the CRJ-700.

The biggest single contributor to the upturn in RJ seats at JFK, however, was jetBlue Airways. Since introducing E-190s, it supplies more than 1.3 million seats with them.

RJs like the E-190 are also operated on point-to-point services where demand may be too low to warrant a mainline jet.

At LAX there was a 149% growth in RJ capacity, and average aircraft size increased slightly to 58, primarily a result of increased services by American Eagle and Delta Connection. More seats were provided on larger RJs, and American Eagle increased its CRJ-700 capacity.

Current orders

The current regional aircraft order backlog for US-based operators reinforces trends identified in the main analysis. Most aircraft on order are RJs, and of the 310 on firm backlog at the end of January 2013, only 24 were turboprops.

ATR72s destined for US-based leasing companies accounted for 14 of these. It is not certain they will end up with US-based airlines.

The 286 RJs on order show the



continuing shift away from smaller 50-seat aircraft. All are 70 seats and above. The 90-seat MRJ90 has the largest number of RJ airframes on order for US operators with 150 in total: 100 are for SkyWest Airlines, while the other 50 are for Trans States Airlines.

Another significant order is 40 CRJ-900s for Pinnacle Airways, to be used on Delta Connection services. There are also 47 E-175s on order for Republic Airlines and 38 E-190s, most of which are for jetBlue Airways.

In its 2012-2031 market forecast, Embraer predicts that the turboprop fleet in North America will increase by 21% over the next 20 years. This compares to a 76% increase in the 61-90-seat jet fleet and a 158% increase in 90-120-seat jets.

Embraer also believes the 30-60-seat regional fleet will contract. It estimates the number of 30-60-seat turboprops will fall by 72%, while RJ aircraft in this size category will fall by 70%. This tallies with the trends identified in this analysis. RJs are more in demand than turboprops, and the regional aircraft that are entering the US fleet are larger.

Optimum size

"If there were no scope clause limitations, we expect that, as in the rest of the world, RJ demand will mainly be for aircraft larger than 70 seats, and especially 90 seats and above," says Bagnato.

Across the 21 hubs analysed, 343 routes were served by both mainline and regional aircraft in 2012. When the average number of seats per flight is calculated across these routes, many would suit a 100-seater. An example is ATL-Piedmont Triad (GSO). Last year

there were more than 300,000 seats on this sector, provided by a mix of Delta's MD-80s, 737s, A319s and A320s, and Delta Connection's CRJ-100/200s, CRJ-700s and CRJ-900s. This led to an average aircraft size of 96 seats.

Summary

The size and type of aircraft operating regional services in the US is clearly influenced and even determined by pilot scope clause restrictions. There has been a trend for these restrictions gradually to lift and allow the use of larger aircraft.

Turboprop numbers in the regional US fleet are declining. The average size of those that remain has increased in recent years, with the 70-seat Q400 providing the most capacity in this segment. Where they are used, turboprops tend to operate shorter sectors of up to 400nm. This is likely to remain their niche in the US.

RJs have entered the US regional fleet in large numbers over the past 20 years. The boom in 50-seat RJs seems to be over, as rising fuel prices make them less economic than they used to be.

Subsequent relaxations of scope restrictions have seen a gradual increase in the average size of RJs in operation. The next few years will see more 70-seat aircraft entering the fleet. Scope clause relaxations have seen larger RJs replace smaller RJs, and also mainline jets.

There is evidence to suggest there would be a market for 100-seat RJs in the US. Numerous routes are served by both regional and mainline aircraft, where average aircraft size is 100 seats. [AC](#)

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