The regional fleet of commercially operated turboprops and RJs totals about 7,300 aircraft. This sizeable fleet generates demand for about 4,100 base maintenance checks per year, as well as various other levels of technical support, and engineering management.

The regional aircraft base maintenance market

The global feet of regional aircraft, turboprops and regional jets (RJs), totals about 7,300 aircraft, compared to a jetliner fleet of about 20,000. The on-going maintenance of the regional aircraft fleet is therefore a large and appreciable market. The fleet distribution and age, the base maintenance programmes and check intervals, the main suppliers of base maintenance capacity, and a brief review of some of the larger regional aircraft maintenance providers are examined here.

The turboprops included in this article are the operational BAE ATP, Beech 1900, Do228/328, BAE Jetstream 31 & 41, Fairchild Metro, Saab 340 & 2000, EMB-110, EMB-120, F.27/Fokker 50, Dash 8 family, Q400, and ATR42 and 72 fleets.

The RJs covered are the operational BAE146/Avro RJ, Fokker 70/100, the ERJ-135/-145, CRJ100/200, CRJ700/900/1000, E-170/-175, and E-190/-195.

These comprise 3,627 turboprops, accounting for 49% of the global regional aircraft fleet; and 3,704 RJs, accounting for 51%. The fleets operated in each of the world's nine main regions are summarised *(see table, page 66)*.

Regional airliner fleet

North America and Europe have the largest and most established regional aircraft operations and fleets, accounting for about 3,700 aircraft or 61% of the 7,300 regional aircraft in operation. Australia and New Zealand have a regional fleet of 372, with a high proportion of turboprops *(see table, page 66)*. This is large compared to the jetliner fleet. Africa operates 606 regional aircraft, two-thirds of which are turboprops. This is also large compared to its jetliner fleet.

Regional airline operations are less prominent elsewhere in the world. China has no turboprops and only larger RJs accounting for most of the RJ fleet *(see table, page 66)*. This is explained by China's demographics, which mean that most of the airline network comprises high-density airport-pairs.

Turboprops

Overall, there are 3,627 turboprops in operation. The combined Dash 8/Q400 fleet total 985 aircraft, is the largest portion of the turboprop. The ATR 42/72 fleet accounts for 992 aircraft.

There are 1,650 ageing turboprops still in service. Most are small, or fewer than 35 seats. The F.27/Fokker 50 fleets now account for 135 aircraft, and there are 45 BAE ATPs and a few HS.748s still in operation, mainly as freighters.

The EMB-110/-120 fleet totals 194 active aircraft, while the Saab 340, plus a few Saab 2000s, totals 265. There are 285 active Fairchild Metro 23s in service, 159 active Jetstream 31s/41s, 117 Do228s/328s, and 450 Beech 1900s *(see table, page 66)*. Large portions of the Beech 1900 and Metro fleets are operated in North America. Latin America, Africa and the Asia Pacific have relatively high numbers of turboprops.

Regional jets

There are 3,704 RJs *(see table, page 66)*. The ageing BAE146/Avro RJ and Fokker 70/100 fleets now account for just over 300 aircraft. The smaller RJs, the ERJ-135/-145 and CRJ100/200 fleet, total almost 1,400 aircraft; while the combined fleets of large CRJ variants and Embraer E-Jets account for 2,016, and so form the largest portion of the RJ fleet and of the overall regional aircraft fleet.

North America

North American airline networks operate around hub-and-spoke systems. The three major carriers remaining in the US are United Airlines, American Airlines and Delta Airlines, all of which operate from several major hub airports, with route maps from each of these hubs resembling spokes of a wheel. Shorter routes and those with lower traffic volumes are operated by regional airlines acting as feeder carriers for the larger airlines' hubs. These are independent carriers operating franchises for the major airlines, so they are branded as representing the major carriers.

The largest regional carriers in terms of fleet size in the US are SkyWest (392 aircraft), Expressjet Airlines (230), Republic Airways (180), Envoy Air (143), Endeavor Air (137), Mesa Airlines (135), PSA Airlines (117), Trans States Airlines (58), Air Wisconsin (57), and Horizon Air (57). Overall, more than 2,000 regional aircraft are operated in the US. Most of these regional airlines operate hub-feeder networks for two or all of the major carriers. Horizon Air is a feeder solely for Alaska Airlines. jetBlue has its own E-190 fleet for lower-density routes.

The larger regional airlines, or airlines with regional aircraft fleets, in Canada are Jazz (120 aircraft), Westjet Encore (39), Porter Airlines (29), Air Canada (25), Skyregional (23), Air Creebec (16), and Air Georgian (16). About 400 regional aircraft are operated in Canada on a commercial airline basis.

Some of these airlines operate similarly to regional feeders in the US. Jazz and Air Canada act as regional operators on Air Canada's shorter and lower density routes, and Westjet Encore operates similarly for Westjet. Porter Airlines operates independently.

The number of turboprops in North America peaked from the late 1980s to the late 1990s. Numbers have since declined as US and Canadian operators have begun to favour RJs because of passenger preference, long-term low fuel prices, and major airlines designating the operation of more of their smaller and less busy routes to their regional feeders. This has resulted in a large number of Embraer E-Jets and CRJ700/900/1000 aircraft being added into fleets.

GLOBAL REGIONAL AIRLINER FLEET

Region	ATP/ HS.748	Beech 1900	Do228/ 328	BAE J31/41	Saab 340/ Metro	Saab 340/ 2000	EMB110/ EMB120	F.27/ Fk50	Dash 8	ATR 42	Q400	ATR 72	Total T.Props
N.America	9	233	13	33	162	65	51	2	216	55	173	29	1,041
Europe	27	26	29	33	27	95	13	15	59	77	167	213	781
Asia Pacific		18	31	2		16		35	53	35	49	250	489
Latin America		47	13	67	56	28	67	14	10	57	2	95	456
Africa	4	116	28	17			41	33	52	25	67	50	433
Aus/N.Zealand		8	3	7	40	59	17	5	69	2	31	40	281
China													0
Middle East							5	22	8	1	4	16	56
Indian continent	5	2				2		9	1	8	24	39	90
Total	45	450	117	159	285	265	194	135	468	260	517	732	3,627

Region	BAE 146/ Avro RJ	Fk 70/ Fk 100	ERJ 135/145	CRJ 100/200	CRJ 700-1000	E-170/ -175	E-190/ -195	Total RJs	Total aircraft	% of Total
N.America	20		400	404	558	452	110	1,944	2,985	40.7
Europe	62	34	150	65	124	81	186	702	1,483	20.2
Asia Pacific	7	21	32	24	27	28	29	168	657	9.0
Latin America	20	5	89	22		15	184	335	791	10.8
Africa	20	3	72	27	13	16	22	173	606	8.3
Aus/N.Zealand	16	57	5			5	8	91	372	5.1
China			28	10	30		98	166	166	2.3
Middle East	27	23	26	1	9	9	11	106	162	2.2
Indian continent			15	3			1	19	109	1.5
Total	172	143	817	556	761	606	649	3,704	7,331	100.0

The largest regional aircraft fleets in North America are almost 400 Dash 8s and Q400s, plus about 80 ATR42/72 turboprops. There are also more than 800 smaller ERJ-135/-145 and CRJ100/200 RJs, and more than 1,100 larger CRJ700/900/1000 and Embraer E-Jets. These are by far the largest fleets of large RJs in the world.

Europe

The European regional fleet is about half the size of that in North America. European airlines operate from major hub airports, but few have their operations fed by regional carriers. A high portion of regional airlines are operated as smaller fleets or as subsidiaries of major airlines, and are used to fly hub-secondary airport routes, or on routes between two secondary cities. This is because landing and other airport user charges are high in Europe, and regional aircraft are operated on routes that avoid frequent use of these hubs. Regional subsidiaries include Swiss, HOP!, Lufthansa Cityline, KLM, Alitalia, Cityhopper, Air Nostrum, LOT Polish, SAS, BA Cityflyer and TAP Express, .

Several regional airlines operate independently, including Flybe, Wideroe, Swiftair, Braathens Regional, Nordic Regional, BMI Regional and City Jet.

Turboprops account for 44% of the regional aircraft fleet, totalling 544 aircraft; a larger share than in North America. The ATR42/72 dominate European turboprop fleets with more than 290 aircraft, while the Dash 8/Q400 fleet is 226 units. The ATR 72 and Q400 are operated in almost equal numbers. The largest fleets are operated by HOP!, Flybe (55 Q400s), Wideroe, Austrian, Air Nostrum, LOT Polish, Nordic Regional, LGW, Swiss and Air Baltic.

The RJ fleet is dominated by larger RJs, but there are still 215 smaller ERJ-135/-145s and CRJ100/200s. The larger fleets are operated by HOP!, Lufthansa Cityline, Flybe and Air Nostrum.

There are 391 large RJs comprising the CRJ700/900/1000 and Embraer E-Jets. The largest fleets are operated by HOP!, Flybe, Lufthansa Cityline, KLM, CityHopper, Austrian, LOT Polish, SAS, Nordic Regional, Alitalia, BA Cityflyer and Swiss.

Unsurprisingly, Europe has the largest fleet of ageing large RJs, with 34 Fokker 70s/100s and 62 BAE146s/Avro RJs.

Asia Pacific

The Asia Pacific, excluding China and the Indian sub-continent, has a fleet half the size of Europe's. Europe's fleet is about half the size of North America's, which shows the relative importance of North America and Europe in the regional market.

The largest operators in the Asia Pacific are Wings Air (51 aircraft), Firefly (41), Garuda (33), J-Air Japan (29), Link PNG (22), ANA Wings (21), Uni Air (15) and Bangkok Air (13).

The Asia Pacific is dominated by turboprops, which account for 422 out of a fleet of 590. The ATR72 is dominant, with 250 aircraft, and a smaller fleet of 35. There are also just over 100 Dash 8s/Q400s. Large turboprop operators include Wings Air, ANA Wings, Firefly, Link PNG, and UNI Air.

There are 168 RJs in the Asia Pacific fleet. Fleets are spread evenly between the ageing large RJs, the smaller ERJ-135/-145 and CRJ100/200 RJs, and larger CRJ models and E-Jets *(see table, this page)*.

China and the Indian sub-continent have a combined fleet of 266 aircraft *(see table, this page)*. The Chinese fleet is dominated by large RJs, most of which are operated by Tianjin Airlines, and regional operator China Express Airlines.

The small fleet of 100 aircraft in India is dominated by turboprops, with 81 aircraft, mostly ATR72s and the Q400s.

Base maintenance

The maintenance market for the regional sector is divided between: line maintenance; base maintenance; component repair and management; and engine repair and overhaul. Base maintenance can be further sub-divided between: base and heavy checks; interior

NUMBER OF ANNUAL C & HMV CHECKS FOR TURBOPROP & RJ FLEETS

Global region	North America	Europe & CIS	Asia Pacific	Indian sub-con	China	Africa	Latin America	Aus & N.Zeal	Middle East	Total checks
Turboprop fleet	518 + 5	375 + 4	276	88 + 3	17	235 + 4	202 + 1	177	19	1,924
RJ fleet	895 + 145	450 + 67	58+ 7	6 + 1	82 + 19	77 + 14	167 + 36	57 + 7	70 + 4	2,162
Total	**1,413 + 150**	**825 + 71**	**276 +7**	**94 + 4**	**99 + 36**	**312 + 18**	**369 + 37**	**234 + 7**	**89 + 23**	**4,086**

Source: ICF

refurbishment; stripping and painting; and heavy modifications.

Over the past 20 years, engine repair and overhaul have evolved, so that most airlines now maintain their engines on engine management and fixed-rate-per-hour contracts, either with the engine original equipment manufacturers (OEMs), or a select number of third-party specialist providers. Exceptions are with the largest fleets, where the large number of engines can justify an airline keeping its own engine shop.

A similar system applies to the provisioning of rotable components. Line maintenance will largely be performed by airlines in-house at home bases, and often by other airlines at outstations.

Base maintenance is the element of maintenance & engineering (M&E) that offers the potential for airlines and third-party specialist providers to take a share of the available market. Most base maintenance comprises scheduled base and heavy checks. The fixed definition of 'C' and 'D' checks, or similar terms, in the maintenance planning documents (MPDs) of aircraft types has now been replaced with groups of tasks that have the intervals and content of base checks. These groups are therefore replacements for C and D checks, and are given generic names by the engineering departments and planning engineers of their operators.

C checks, or lighter base checks, comprise a high portion of system and zonal tasks. Most types also have some structural tasks in their lighter C checks. Most of these are relatively light and have low access requirements, or they have high threshold intervals and come due for the first time when the aircraft is in its second or third base check cycle.

Heavy maintenance visits (HMVs) or 'D' checks are often the fourth or fifth check in a cycle of base checks. These have a high portion of deep access structural tasks, so they often require the removal of a large portion of the aircraft's interior and floor boards, and other items. These checks therefore often provide the opportunity for refurbishing the aircraft's interior at the same time as stripping and repainting its exterior, and incorporating large modifications.

While maintenance programmes vary between the operators of a type, they all have the same mandatory tasks from the MPD with the same intervals. Base check programmes therefore vary little between operators if block check maintenance is adhered to. The base maintenance programmes of each type, and the check intervals and sequence of lighter and heavier base checks and their probable downtimes can be used to estimate the likely size of the base maintenance market for regional aircraft on each continent. The first factor that has to be taken into account is check interval utilisation. Checks are performed at 80-85% of scheduled interval, so an MPD interval for a C check means the actual interval is likely to be 19-20 months.

The market for base maintenance is added to by extra requirements generated by airlines for unscheduled interior refurbishment, stripping and re-painting, and large or heavy modifications where it was not possible to perform these simultaneously with a base check. There is also the added cost of bridging checks when an aircraft changes lessees.

The main regional aircraft types' base maintenance programmes and typical rates of utilisation are briefly examined.

ATR 42/72

The ATR 42/72 are used on routes with an average flight time of 55 minutes, so the fleet generates an average annual utilisation of 1,800 flight hours (FH) and 1,900 flight cycles (FC).

The ATR MPD has an A check cycle of 500FH, with a cycle of four checks.

The ATR's base check cycle pattern is four base checks, with a standard interval of 5,000FH. Checks can take place every 33 months, but every 29-30 months is more likely. There are several base check structural and deep access tasks with intervals that are multiples of 24 months (MO), and a fourth heavy C check with an eight-year interval, so airlines may find it convenient to perform base checks at 24MO intervals. Base check downtime will be 1-2 weeks.

Dash 8 & Q400

The Dash 8 and Q400 have a relatively simple MPD and maintenance programme. Most tasks have FH intervals, and are formed into four main groups of 1C, 2C, 3C and 4C tasks. These have an interval in multiples of 6,000FH, having been escalated from 5,000FH and 4,000FH for the two types.

These groups can be conveniently formed into block checks for base checks. The four task groups therefore do not all come into phase until the 12th base check, often referred to as the C12 check. The C4, C8 and C12 checks, which take place every fourth check, are the heavier checks, and both types of aircraft have a base check cycle of four checks.

The Dash 8 has average annual utilisations of 1,800-2,300FH. With the base C check interval at 5,000FH, the checks come due at a maximum calendar interval of 26-33 months, and actual check interval is likely to be 20-27MO.

The Q400 has a slightly higher annual utilisation of 2,400FH, so the maximum check interval is 30MO. The actual interval will be 24-27MO for most operators, so the cycle of four base checks will be completed every seven to eight years.

ERJ-134/-145

The ERJ-135/-145 has a relatively simple maintenance programme. It has base or 'C' check tasks with a standard interval of 6,000FH. There are three main types of tasks: FH, structural inspection (SI), and corrosion prevention and control programme (CPCP) tasks. The SI tasks have intervals in FC, while CPCP tasks have calendar intervals.

There are four groups of FH tasks: the 1C, 2C, 3C and 4C tasks. When formed into block checks they form a base check cycle of four checks, although not all task groups come into phase until the 12th check. Every fourth check is a heavy check, so the base check cycle has an interval of 24,000FH, equal to just over eight years at average annual utilisations of 2,500FH.

There are three groups of SI tasks, with intervals of 5,000FC, 10,000FC and 20,000FC. These are thus combined and grouped with the 1C, 2C and 4C tasks.

There are three main groups of CPCP tasks, with multiples of 30MO, 60MO and 120MO. These are combined with the 1C, 2C and 4C tasks.

The three main groups of tasks form the C1, C2, C3 and C4 checks. The likely actual interval will be 22-24MO.

CRJ100/200, 700/900/1000

The CRJ family has a relatively complex MPD, with large groups of same-interval tasks that can be grouped to form a pattern of major checks, and a large number of out-of-phase (OOP) tasks with different intervals to groups of tasks. There are also many structural tasks with a lot of different initial and repeat calendar intervals specified in MO, and in multiples of 12MO. These factors make check-planning complex.

The CRJ100/200's base check programme can be organised into a cycle of five checks, with a standard interval of 5,000FH *(see CRJ family airframe maintenance analysis, Aircraft Commerce, August/September 2016, page 40)*. Given average annual utilisations of 2,300FH, base checks are performed every 24MO or 2 years (YE). The large number of structural tasks means that most base checks are heavy because they have deep access tasks. The CRJ100/200's calendar structural tasks have intervals of 12MO, 36MO, 60MO, and others that fall between the 2YE base check intervals have to be performed in larger A checks.

The larger CRJ700/900/1000 have a different MPD to the CRJ100/200. They also have a pattern of five base checks, but a longer standard interval of 6,000FH. These aircraft are operated on marginally longer route lengths than the smaller CRJ100/200, so the larger variants have average annual utilisations of 2,300-2,500FH. Base checks are therefore performed every 25-28MO.

The CRJ700/900/1000 have several structural tasks with intervals of 12MO, 18MO, 24MO, 7MO, and 144MO. The tasks with the deepest access requirements, involving the removal of the interior and cabin floor, have a combined interval of 12,000FH and 6YE.

E-Jets

The Embraer E-Jet family is split into two groups: the E-170/-175, and E-190/-195 with an MPD for each. Both MPDs are complex, with large numbers of tasks with FH, FC and calendar intervals.

The FH tasks are grouped to form a pattern of base checks with a standard interval of 7,500FH, and a fourth base check to complete a cycle. There are also substantial numbers of base check tasks which fall halfway between these base checks, and are referred to as 'half checks' *(see E-Jets airframe & base maintenance analysis, Aircraft Commerce, August/September 2015, page 41)*. There are in fact a large number of FH intervals, so many tasks have to be brought forward.

Given average annual utilisations of 2,400-2,700FH, the 7,500FH interval is equal to 38MO. The fourth base check therefore has a maximum interval of 30,000FH, equal to about six years.

All base check groups have deep access tasks, especially the third group at about 22,500FH.

There are also more than 400 FC tasks with intervals of 6,250-40,000FC. These are grouped into the base checks. The FC tasks grouped into the third group of base check tasks is the largest, and many of these have deep access requirements. Every third base check therefore has a heavy labour input and extended downtime.

There is a large number of calendar tasks. Like FH and FC tasks, many are brought forward to form groups of base check tasks. The tasks in the second and third group are high in number, and most are also deep access tasks.

The global turboprop fleet generates about 1,900 base checks per year, while fleets in North Amercia and Europe generate about 520 and 380 base checks per year.

Base maintenance market

While there are differences between airline approved maintenance programmes (AMPs) for the same aircraft type, and between the MPDs of different aircraft types, base check programmes generally have an actual check-performed interval of close to 24MO.

This suggests that, for a fleet with an even age profile, the number of C and HMV checks per year for each type, and the global fleet as a whole, will be 50-55% of the number of aircraft in the fleet. This takes into account additional requirements for end-of-lease and bridging airframe checks. On this basis, 4,400 annual base checks will be needed.

Turboprop fleet

ICF Consulting generates annual estimates of the number of C and HMV airframe checks for the global turboprop and RJ fleet. It subdivides these into the number of C and HMV checks for each global region, and by main aircraft type.

ICF estimates that 2,000 C checks will be needed annually for the global turboprop fleet *(see table, page 68)*, with the number forecast to change little over the next 10 years. ICF also estimates that only 20 HMV checks will be needed for the entire global turboprop fleet. This is equivalent to 55% of the global fleet size, indicating on average an aircraft has a base check once every 22 months.

ICF estimates that 518 C checks will be performed for the North American fleet, including the Caribbean *(see table, page 68)*, and five HMV checks.

Europe and the Commonwealth of Independent States (CIS) will generate the second largest portion with about 375 C checks, as well as four HMV checks *(see table, page 68)*.

The Asia Pacific, excluding the Indian sub-continent and China, are forecast to generate 276 C checks and HMV checks during 2017. The fleet in the Indian sub-continent is predicted to generate about 100 C and HMV checks in 2017.

Africa is the fourth largest market, at about 240 C and HMV checks per year, while Latin America is the fifth largest at just over 200 C and HMV checks in 2017 *(see table, page 68)*.

The turboprop fleet in Australia and New Zealand is predicted to generate 180 C and HMV checks during 2017.

The Middle East, which has the smallest fleet, will need 19 or 20 base airframe checks per year.

When broken down by model, the two largest fleets, the ATR 42/72 and Dash 8/Q400, generate the largest number checks. While the two global fleets of these types are similar in size, the ATR fleet generates almost 600 C checks per year, and the Dash 8/Q400 fleet only 434 checks *(see table, page 72)*.

The third largest number comes from the Beech 1900, with 450 aircraft still in operation, mainly in North America. Other turboprops that generate a significant number of checks each year are the larger fleets of Saab 340s/2000s, EMB-110/-120, and BAE Jetstreams.

Regional jet fleet

The RJ fleet of about 3,700 units generates an estimated 1,860 C checks and 300 HMV checks per year, a total of just under 2,100 base checks for the global fleet *(see table, page 72)*. This is equal to 59% of the fleet having a base check per year, indicating that on average an RJ has a base check once every 20 months.

As would be expected, the North American and Caribbean fleet of 1,944 aircraft generates the largest number of checks at 895 for C checks and 145 HMV checks *(see table, page 68)*.

The European fleet of about 700 RJs generates a requirement for 450 C checks per year, plus 67 HMV checks *(see table, page 68)*.

Other regions of the world generate a smaller number of checks, as reflected by the smaller fleets. The Asia Pacific (not including the Indian sub-continent and China), with 590 RJs, is only predicted to need 58 C and seven HMV checks in 2017 *(see table, page 68)*. The small number of checks in relation to the fleet is a reflection of the relatively young age distribution of the fleet in this part of the world.

Unsurprisingly the Indian sub-continent is forecast to generate fewer than 10 base airframe checks in 2017, while the RJ fleet in China is predicted to only require 82 C and 19 HMV checks *(see table, page 68)*.

The remaining four regions of the world are: Latin America, with 167 C and 36 HMV checks per year; Africa, with 77 C and 14 HMV checks per year; the Middle East, with 70 C and four HMV checks per year; and Australia and New Zealand, with 57 C and seven HMV checks per year *(see table, page 68)*.

When analysed by aircraft type, the Embraer E-Jet and Bombardier CRJ families generate the largest number of annual C and HMV base checks. The CRJ fleet, with 1,371 aircraft in active service globally, generate an annual requirement of 692 C checks and 89 HMV checks, a total of 781 base checks per year *(see table, page 72)*.

The smaller E-Jet fleet at 1,255 aircraft has an annual requirement for 651 C and 113 HMV airframe base checks in 2017 *(see table, page 72)*.

The ERJ-135/-145 has the third largest fleet of 817 active aircraft, and will need 204 C and 87 HMV base checks in 2017.

The smaller fleets of ageing BAE 146/Avro RJs and Fokker 70/100s generate 104 and 132 base checks per year *(see table, page 72)*. These numbers are expected to decline over the next 10 years.

Airline demand

ICF has forecasts for the number of

NUMBER OF ANNUAL C & HMV CHECKS BY TURBOPROP & RJ TYPE

Aircraft type	ATR 42/72	Dash 8/ Q400	Beech 1900	Saab 340 /2000	EMB -110	BAE 31/41	Do228/ 328	Fokker 50	BAE ATP	Total
Turboprop	592	434	197	146	111	91	63	59	18	1,711

Aircraft type	E-Jet	CRJ	ERJ-145	BAE 146/ Avro RJ	Fokker 70/100	Total
RJ fleet	651 + 113	692 + 89	204 + 87	104	127 + 5	2,072

TOP 10 AIRLINES WITH HIGHEST NUMBER OF NUMBER OF ANNUAL C CHECKS FOR TURBOPROPS & RJs

Airline	SkyWest Airlines	Express Airlines	Endeavor Air	Envoy Airlines	Mesa Airlines	Jazz	Republic Airlines	PSA Airlines	Horizon Air	Shuttle America	Total
Checks	184	159	84	66	77	69	47	50	34	23	793

Airline	Tianjin Airlines	Wings Air	Regional Express	Garuda Indonesia	China Express	Alliance Airlines	Reignwood Aviation	Mount Cook Airline	Air Costa	Virgin Australia	Total
Checks	30	42	30	21	21	22	3	23	0	16	208

Airline	Flybe	Air Nostrum (Iberia reg)	KLM Cityhopper	HOP!	Lufthansa CityLine	Austrian Airlines	CityJet	Wideroe	Brit Air	Binter Canarias	Total
Checks	31	35	29	28	31	34	19	21	21	12	261

Airline	Iran Air	Iran Asmen Airlines	Mahan Air	Saudia	Iranian Naft Airlines	Qeshm Air	Abu Dhabi Aviation	Iraqi Airways	Arkia Israeli Airlines	Felix Airways	Total
Checks	11	15	13	13	4	5	3	5	3	2	74

Airline	AZUL	Aeromexico Connect	Interjet	Austral	Conviasa	Passaredo	Aeromar	SEARCA Colombia	Easyfly	SATENA	Total
Checks	69	37	13	17	8	7	9	14	8	8	190

Airline	SA Airlink	Solenta Aviation	Sonair	Air Algerie	SA Express	Precision Air Services	Kenya Airways	Ethiopian Airlines	Bluebird Aviation	CemAir	Total
Checks	15	9	10	9	8	7	8	9	9	8	92

Source: ICF

checks generated by the airlines with the largest fleets in the six main regions of North America, Europe, the Asia Pacific, South America, Africa, and the Middle East.

The North American fleet is predicted to generate 891 C checks in 2017, and 800 are accounted for by 10 airlines. SkyWest Airlines, with a fleet of 422 aircraft, is forecast to need 184 C checks during the year. ExpressJet Airlines with 224 aircraft is predicted to require 159 C checks. The number of C checks for Endeavor Air, Envoy, Mesa Airlines, Jazz, Republic Airlines, PSA Airlines, Horizon Air, and Shuttle America is forecast to be 450. This compares to a combined fleet of 96 turboprops and 873 RJs.

The European airlines with the largest requirement for base checks during 2017 are Air Nostrum (35 checks), Austrian Airlines (34), Flybe (31), Lufthansa Cityline (31), KLM Cityhopper (29), HOP! (28), Wideroe (21), Brit Air (21) and Binter Canarias (12).

Airlines in the Asia Pacific generating the largest demand are Wings Air (42 checks), Tianjin Airlines (30), Regional Express (30), Mount Cook Airlines (23), Alliance Airlines (22), Garuda Indonesia (21), China Express Airlines (21) and Virgin Australia (15).

The airlines generating the largest demand for C checks in 2017 in South America, Africa and the Middle East are summarised *(see table, page 72)*.

Base maintenance suppliers

The market of 4,200 annual base checks (2,000 for turboprops and 2,200 for RJs), is catered for by airline M&E departments, which carry out in-house and third-party maintenance; and independent third-party suppliers.

North America and Europe have almost 4,500 operational turboprops and RJs, equal to 61% of the global fleet. ICF estimates the annual number of C and HMV checks for turboprops and RJs in these two regions to be 2,460: 1,563 in North America and 896 in Europe.

Some of the larger independent providers of regional aircraft base maintenance capacity are examined here.

North America

The North American regional aircraft fleet is dominated by large airlines with their own maintenance facilities and in-house capability. There is still a substantial number of independent base

SkyWest provides regional feeder services for Alaska Airlines, American Airlines, Delta Airlines and United Airlines. SkyWest has the largest fleet of all North American and Global regional carriers, and its fleet of 422 aircraft is estimated to generate 184 C checks during 2017.

maintenance suppliers, and these provide capacity for many regional operators with smaller and medium-sized fleets.

AAR is the largest supplier of third-party base maintenance capability for regional aircraft. It has five base maintenance facilities in the US. The first is its AAR Aerostructures, Clearwater, FL facility, which has base check capability for the CRJ and EMB-120. Three other facilities have capability for the same types: AAR Aircraft Services, Duluth, MN; AAR Aircraft Services, Hot Springs, AR; and AAR Aircraft Services, Miami, FL. AAR also has a comprehensive facility at AAR Aircraft Services, Oklahoma, OK. This is the largest of AAR's regional aircraft base maintenance operations, and it has capability for the BAE J31/41, Dash 8, F.27, Fokker 50, ERJ-135/-145 and the CRJ.

Aero Aviation, Calgary, Canada has a wide and comprehensive capability. This includes the ATR 42/72, F.27, Dash 8 family, Saab 340, CRJ, BAE 146/Avro RJ, F.28, and Fokker 100.

Avmax, Calgary, Canada is one of the larger providers of regional aircraft maintenance in North America. As well as its Calgary base, which has four bays for base maintenance, it has two US facilities at Great Falls, MT (with three bays) and Jacksonville, FL (with four bays). Avmax has comprehensive capability, including the Dash 8, Q400, CRJ family, and ERJ-145.

Avmax performs almost 40 base checks per year. It also provides interior refurbishment, modifications and upgrades, strip and repaint, and heavy component repairs.

Stambaugh Aviation is based in Brunswick, GA. It has comprehensive aircraft base maintenance capabilities, including jetliners and regional types. It has 85,000 square feet of facility space with two hangar bays. It mainly has capability for older regional aircraft types, including the F.27, Saab 340, ATR 42/72, BAE 146/Avro RJ, F.28 and Fokker 100. It completes about 100 aircraft visits per year, including jetliners.

Europe

Europe has a large number of regional aircraft maintenance providers across the 28 countries of the European Union (EU), as well as some (CIS) countries.

Large maintenance providers are located in the United Kingdom, France, Germany, The Netherlands, Spain, Denmark and Norway.

Air Nostrum is a regional subsidiary of Spanish flag carrier Iberia. Air Nostrum's facility is located in Valencia, and provides maintenance for the airline's ATR72 and CRJ200/900/1000 fleet. It has seven hangar bays, and performs an average of 40 base checks per year, of which 25% are for third-party customers.

HOP! is a regional subsidiary airline of Air France, and operates a fleet of 88 aircraft that include ATR 42s/72s, CRJ700s and CRJ1000s, ERJ-145s, and E-170s and -190s. The airline has two base maintenance facilities in France: one at Clermont Ferrand with four bays; and another at Morlaix with two. These two facilities generate an average of 45 base checks per year. HOP! offers its capabilities to third-party customers.

Medavia is a small regional airline on the Mediterranean island of Malta, and has a comprehensive facility with four hangar bays, two of which are for base maintenance. In addition to jetliner types, Medavia has capability for the Dash 8 and Q400 family, Beech 1900, and BAE 146/Avro RJ. Medavia completes about 40 base checks per year, 24 of which are for regional aircraft types.

Medavia's small fleet means that about 80% of its maintenance capacity is available to third-party customers.

Rheinland Aircraft Services (RAS) is located at Moenchengladbach, Germany. It is a facility with mixed capability for narrowbody jetliners and a range of regional turboprops. Turboprop capabilities include the Dash 8 family, F.27, and Fokker 50. The main type that is catered for, however, is the ATR 42/72.

RAS is a specialist for the ATR 42/72. It offers comprehensive support, and has a large inventory of rotables and structural parts since it also specialises in tearing down and dismantling aircraft. Its facility has up to eight ATR production lines, which can be used for light checks, engine changes and major modifications in addition to base checks.

RAS's main customers include Stobart Air, Air Dolomiti, Castlelake, Airlinair, HOP!, Aer Arann, Air Contractors, West Air Sweden and FARNAIR Europe.

Samco at Maastricht in the Netherlands has base maintenance capability for the ATR 42/72, Dash 8, Q400, CRJ family, and ERJ-134/-145. It has five base hangar bays, and completes 60-80 base checks per year. Customers include Cityjet, Wideroe, ASL Airlines, Air Baltic, Falko, and Elix Aviation.

Skyways Technics of Denmark has taken over the maintenance facilities of Cimber Air Maintenance Centre. It has two facilities in Denmark, in Sonderborg and Billund, which have seven base maintenance bays between them, and offer capability for the ATR 42/.72, ERJ-135/-145, CRJ200, and the 737 Classic and NG. Most of its customers are ATR operators and lessors.

Wideroe operates a fleet of 30 Dash 8s and 11 Q400s from several hubs in Norway that include Bergen and Oslo. It performs base maintenance on its fleet at its facility in Bodo which has three base hangar bays. It performs an average of 20 base checks per year, and offers capability to third-party customers. - *CHW* AC