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## Available UK airport capacity under a 2050 CO<sub>2</sub> target for the aviation sector

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An AEF report for WWF-UK, July 2011

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### EXECUTIVE SUMMARY

The Minister for Aviation, Rt Hon Theresa Villiers MP, recently said<sup>1</sup>, we need to “*make the most of the airport capacity we already have*”. WWF-UK fully supports this view. To this end, we commissioned the Aviation Environment Federation (AEF) to conduct an analysis of available terminal and runway capacity, at both the national and regional level, using the most up-to-date sources. We wanted to see how close we are to meeting the limits to growth recommended by the Committee on Climate Change (CCC) and the extent to which, by region, there is either over or under provision of capacity, based on official forecasts of regional demand.

This is not to say that we would like to see all planned or permitted aviation growth go ahead. Nor are we recommending that this analysis be used to justify regional airport expansion. But we do believe that this analysis shows that any further expansion, beyond that which is already consented, would come at the expense of achieving our climate change targets.

WWF-UK supports the CCC’s recommendation that the Government should plan according to the ‘likely’ scenario<sup>2</sup>, which allows for a 60% increase in passenger demand and 55% increase in Air Traffic Movements (ATMs) to 2050, compared to 2005 levels. We believe that this scenario constitutes the best basis for the planning of future aviation policy.

WWF-UK is keen to see climate change at the heart of the UK’s future aviation policy. We welcome the Coalition Government’s continuing commitment to no new runways in the Southeast, as well as support for domestic tourism. The DfT’s three themes for the scoping document that will be used to inform the framing of future policy, i.e. the role of aviation in supporting economic growth and delivering low carbon goals, including non-CO<sub>2</sub> and local environment impacts, are also well chosen.

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<sup>1</sup> Rt Hon Theresa Villiers MP, Minister of State for Transport, DfT, *Aviation in the 21<sup>st</sup> century*, Westminster Energy Environment & Transport Forum, 17 March 2011

<sup>2</sup> Committee on Climate Change, *Meeting the UK aviation target* (December 2009)



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WWF welcomes these initial policy statements. We need a new aviation policy that recognises developments in climate change policy, acknowledges the need for demand management and modal shift, and sets robust emissions targets—at a minimum requirement matching the stringency of the existing policy to keep carbon emissions from aviation at or below 2005 levels by 2050.

AEF's research shows that:

- In most regions, available runway and terminal capacity is sufficient to meet demand until 2050, associated with the CCC's likely scenario, without the need for further expansion;
- The main under provision is a modest shortfall in terminal capacity in Scotland and the North of England; a more ambitious stance towards rail and the promotion of videoconferencing will help to address this shortfall;
- An increase in average passengers per aircraft at Heathrow, using the BAA's own forecasts (from 143 to 198 passengers per aircraft by 2050), plus a modest 15% increase in loading at other Southeast airports over the next forty years will be sufficient to meet future demand for runway capacity, without the need for further expansion.

WWF-UK believes that there are several policy conclusions that emerge from this research:

Firstly, only very small increases will be permissible over a 40 year period, to be consistent with the limits to growth recommended in the CCC's limited scenario. This is in contrast with the business as usual approach of some local councils and authorities, such as at London City Airport, Southend, and Farnborough, which are consenting to new expansion plans based on the now outdated, and discredited, 2003 Air Transport White Paper (ATWP). Unconstrained growth at this local level would put us on an unsustainable trajectory of aviation growth.

Secondly, the Government's decision to halt runway expansion in the Southeast is well justified, given that available capacity provision is sufficient to meet future demand.

Thirdly, a new airport in the Southeast to further expand capacity, such as in the Thames Estuary, is not necessary. This can be followed through by support for ongoing efforts to increase aircraft loading.

Finally, and most importantly, the research demonstrates that meeting the CCC's likely scenario can be easily achieved with the capacity we already have. We hope that this will encourage the Government to recommend acceptance of the likely scenario when it responds to the CCC's aviation report this July. WWF believes that this will provide the best basis for formulating a UK aviation policy that is most in keeping with meeting our climate change targets.

## Available UK airport capacity under a 2050 CO<sub>2</sub> target for the aviation sector

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### Introduction

In January 2009 the Government adopted a target to reduce UK aviation emissions back to 2005 levels (37.5 Mt CO<sub>2</sub>) in 2050, and requested the Committee on Climate Change (CCC) *“to assess scope for [emissions] reductions, including from improvements in technology and the effect of appropriate policy levers; and the implications of further aviation expansion beyond 2020”*. The Committee’s assessment of options for reducing UK aviation emissions in line with the target was published in December 2009 as *“Meeting the UK aviation target – options for reducing emissions to 2050”*.

The report scrutinised the likely trajectory for emissions from the sector out to 2050 and the mitigation potential offered by new technology and biofuels, as well as likely trends in modal shift and the uptake of video-conferencing. Three scenarios were developed representing “likely”, “optimistic” and “speculative” emissions pathways over the next 40 years. The “likely scenario” reflects changes to demand and emissions that are likely given current policies and investment levels and the current pace of technological advance. A significant shift in policy and investment is assumed for the optimistic scenario coupled with an increase in the deployment of biofuels, while the speculative scenario relies upon technological breakthroughs, the faster introduction of efficiency improvements and the development of biofuels on a scale that is considered unrealistic today.

The study concluded that *“.. an increase in ATMs of around 55% relative to 2005 levels would be compatible with the target of ensuring that 2050 CO<sub>2</sub> emissions did not exceed the 2005 level of 37.5 MtCO<sub>2</sub>. Given increasing load factors over time, an increase in passengers of around 60% on 2005 levels by 2050 would be possible, taking total annual passenger numbers from 230 million to around 370 million”*.

The Committee advised that future airport policy should be designed in line with this analysis, but additional measures will still be required to achieve the target: even under the likely scenario, demand will grow by 115% resulting in emissions higher than the maximum permitted under the target. Hence, *“Meeting the 2050 target ... is therefore likely to require policy measures to restrain demand which go beyond our central projected carbon price. The policy instruments which could achieve this restraint include a carbon tax on top of the forecast carbon price, limits to further airport expansion, and restrictions on the allocation of take-off and landing slots even where airports have the theoretical capacity available”*.

The report focuses on CO<sub>2</sub> emissions but notes that non-CO<sub>2</sub> effects could be significant. The only option to include non-CO<sub>2</sub> effects in the future without presenting wider

challenges for meeting the UK's overall target of an emissions reduction of 80% by 2050, it argues, is to adapt the current aviation target to include non-CO<sub>2</sub> effects with total CO<sub>2</sub> equivalent emissions. Current scientific understanding suggests that the total impact of aviation on climate change is approximately twice that of its CO<sub>2</sub> emissions alone. This would require a considerable tightening in the current 2050 CO<sub>2</sub> target for the aviation sector.

## Scope

To better understand the implications for airport capacity of compliance with the CCC's advice, WWF-UK asked AEF to assess the maximum terminal and runway capacity at UK airports, including both existing capacity and that for which planning permission (or permitted development rights) had already been granted (Part 1 of the study). Based on an airport-by-airport review of all the airports identified in the 2003 Air Transport White Paper as requiring a master plan, and a national aggregation of these figures, AEF's initial work suggested that sufficient airport runway capacity exists today to accommodate the maximum level of growth considered possible by the CCC. At a national level, this means that further airport expansion (beyond existing permissions) is not required to meet future aviation demand under this scenario. In November 2010, WWF requested AEF to build upon and refine this assessment to test whether the conclusion applies regionally as well as nationally (Part 2 of the study).

## PART 1 – NATIONAL OVERVIEW OF AVAILABLE UK AIRPORT CAPACITY

### Part 1 methodology

Information on the available terminal and runway capacity at each airport was drawn from several sources including individual airport Master Plans, airport operators, the relevant Local Planning Authorities (based on planning applications and decisions), and the 2003 Air Transport White Paper (ATWP) and its supporting documents. Capacities were defined using annual air transport movements (ATMs) and passenger throughput (in mppa). In cases where no planning restrictions were in force on runway utilisation, the capacity level was based on the assessments undertaken for the ATWP (which take into account the limitations of current dimensions, availability of taxiways and geographical location). Where there were no planning constraints on available terminal capacity, estimates were based on the limitations of existing infrastructure as declared by the airport operator. As the purpose was to create a snapshot of the capacity of the UK's airport system as it stands today, proposed developments that have not received planning approval were not included.

The Air Transport Movement (ATM) data was taken directly from the airport statistics collated and published by the Civil Aviation Authority (at the time of writing, the last available annual data set was for 2009). Figures for total movements (including non-

commercial flights) were in some cases higher than the ATM figures, particularly at airports where runway capacity was not a significant constraint. At Liverpool, for example, the proportion of ATMs relative to total movements is only 54.44%. The report assumed that when capacity becomes scarce, non-commercial flights are displaced to maximise revenue, so the figure for Air Transport Movements was used throughout.

### Airport-by-airport Analysis of Current UK Airport Capacity

Airport	2009 pax (mppa)	Available terminal capacity in mppa	Available % growth in mppa	2009 ATMs	Max ATMs (based on ATWP or planning constraints)
Heathrow	66.04	95.00	44	461,096	480,000
Gatwick	32.39	46.50	44	246,690	282,000
Stansted	19.96	35.00	75	157,465	264,000
Luton	9.12	10.50	15	78,169	100,000
London City	2.80	4.56	63	73,677	120,000
Birmingham	9.10	18.00	98	94,392	169,119
Edinburgh	9.05	13.00	44	111,059	173,000
Glasgow	7.23	8.00	11	77,874	169,000
Bristol Int.	5.64	10.00	77	53,836	135,000
Liverpool	4.88	6.50	23	43,174	177,000
East Midlands	4.66	6.00	29	59,964	220,000
Newcastle	4.59	6.00	31	49,970	165,000
Belfast Int.	4.55	6.50	43	44,796	195,000
Aberdeen	2.98	3.50	17	99,419	175,200
Manchester	18.72	35.00	87	162,272	330,000
Blackpool	2.77	2.00	-28	12,356	50,000 (est.)
Belfast City	2.62	4.00	53	38,433	45,000
Leeds Bradford	2.57	3.75	46	32,931	167,000
Prestwick	1.82	3.00	65	15,496	186,000
Southampton	1.79	3.00	68	40,792	70,000 (est.)
Cardiff	1.63	3.00	84	20,537	170,000
Bournemouth	0.89	1.25	41	9,288	170,000
Doncaster	0.84	2.30	175	6,550	56,918
Exeter	0.80	1.00	26	13,888	135,000
Inverness	0.59	0.90	52	15,791	164,000
Norwich	0.43	0.50	16	23,717	30,000 (est.)
Newquay	0.39	0.90	133	12,658	50,000
Humberside	0.34	0.75	123	14,733	199,000
Teesside	0.29	3.00	936	6,473	156,000
Plymouth City	0.16	0.40	153	8,607	145,000
<b>Total</b>	<b>219.63</b>	<b>333.81</b>	<b>52</b>	<b>2,086,103</b>	<b>4,948,237</b>

Sources: 2009 data for airport passenger and ATM traffic – Civil Aviation Authority; Available capacity – ATWP 2003, Airport Master Plans, Local Planning Authorities – a full listing is given in Appendix A.

On a national level, the totals indicate that a 52% growth in passengers above 2009 levels would be possible within current capacity constraints, and that there is sufficient runway

capacity available for ATMs to accommodate more than a doubling in current traffic levels. The available terminal capacity in the UK is thus already closely aligned with the CCC's "likely scenario" that allows for growth of up to 60%, while available runway capacity is not a constraining factor (the CCC's analysis showed that 3.4 million ATMs in 2050 would be compatible with the 2050 CO<sub>2</sub> target).

## PART 2 – REGIONAL OVERVIEW OF AVAILABLE UK AIRPORT CAPACITY

### Part 2 methodology

Demand in each region was assessed using official forecasts of regional demand at the time of the Future of Air Transport White Paper 2003 (ATWP). The ATWP divided the UK's airports into regions: the South East and East, the South West, the Midlands, the North, Wales, Northern Ireland and Scotland. In total the ATWP planned for growth to 470 million passengers per annum (mppa), though this assumed that a series of planning permissions would be secured. The proportion of demand in each region was used in this report to calculate regional allocations of both passengers and traffic using the CCC's assessment of a permitted 60% increase in passengers numbers over 2005 levels. This shows how regional levels of demand permitted under the 2050 target compare with the original analysis of available capacity for airports serving each region, highlighting the significance of any shortfall or over capacity by region.

Several sensitivity tests were performed to check the robustness of the data. More recent data sources such as the 2007 and 2009 DfT Demand and CO<sub>2</sub> forecasts were reviewed to identify whether regional variations had occurred since 2003. Furthermore, each airport in the original study was re-examined in the regional context to assess the likelihood of airports proceeding with all the planning consents and permitted developments (e.g. because they are in areas of low regional demand or because they are at small airports in non-strategic locations that are unlikely to see much growth). Wider constraints in the regional "system" of airports that could affect an airport's ability to grow (e.g. airspace considerations) were also considered. This airport-specific breakdown helped to inform an assessment of how close the airport system was to exceeding the CCC's growth limits in areas of high demand, and whether any airports had the potential to grow to a significant size without further planning permissions.

### Airports by region

Using the ATWP methodology, airports were allocated to regions as follows:

**South East & East:** Heathrow, Gatwick, Stansted, Luton, City, Southampton and Norwich;

**South West:** Bristol, Bournemouth, Exeter, Plymouth and Torquay;

**Midlands:** Birmingham and Nottingham East Midlands;

**Scotland:** Edinburgh, Glasgow, Aberdeen, Prestwick and Inverness;

**North of England:** Manchester, Liverpool, Newcastle, Blackpool, Leeds Bradford, Robin Hood Doncaster Sheffield, Humberside and Teesside;

**Wales:** Cardiff;

**Northern Ireland:** Belfast International and Belfast City.

### Regional capacity based on existing planning permissions/permitted development rights

Based on the original study of available capacity, the capacity for each region is as follows:

Airport	2009 passengers (million)	Available terminal capacity in mppa	Available growth %	2009 ATMs	Max ATMs	Available growth %
<b>Midlands Region</b>						
Birmingham	9.10	18.00	97.74	94,392	169,119	79.17
Nottingham East Midlands	4.66	6.00	28.81	59,964	220,000	266.89
<b>Sub-total</b>	<b>13.76</b>	<b>24.00</b>		<b>154,356</b>	<b>389,119</b>	
<b>Northern Ireland Region</b>						
Belfast International	4.55	6.50	42.97	44,796	195,000	335.31
Belfast City	2.62	4.00	52.57	38,433	45,000	17.09
<b>Sub-total</b>	<b>7.17</b>	<b>10.50</b>		<b>83,229</b>	<b>240,000</b>	
<b>North of England Region</b>						
Manchester	18.72	35.00	86.92	162,272	330,000	103.36
Liverpool John Lennon	4.88	6.50	33.07	43,174	177,000	309.97
Newcastle	4.59	6.00	30.78	49,970	165,000	230.20
Blackpool	2.77	2.00	-27.76	12,356	50,000	304.66
Leeds Bradford	2.57	3.75	45.66	32,931	167,000	407.12
Robin Hood Doncaster Sheffield	0.84	2.30	175.20	6,550	56,918	768.98
Humberside	0.34	0.75	122.78	14,733	199,000	1250.71
Teesside	0.29	3.00	936.40	6,473	156,000	2310.01
<b>Sub-total</b>	<b>35.00</b>	<b>59.30</b>		<b>328,459</b>	<b>1,300,918</b>	
<b>Scotland Region</b>						
Edinburgh	9.05	13.00	43.66	111,059	173,000	55.77
Glasgow	7.23	8.00	10.73	77,874	169,000	117.02
Aberdeen	2.98	3.50	17.27	99,419	175,200	76.22
Glasgow Prestwick	1.82	3.00	65.04	15,496	186,000	1100.31
Inverness	0.59	0.90	52.18	15,791	164,000	938.57
<b>Sub-total</b>	<b>21.67</b>	<b>28.40</b>		<b>319,639</b>	<b>867,200</b>	
<b>South East &amp; East Region</b>						
London Heathrow	66.04	95.00	43.86	461,096	480,000	4.10
London Gatwick	32.39	46.50	43.55	246,690	282,000	14.31
London Stansted	19.96	35.00	75.38	157,465	264,000	67.66
London Luton	9.12	10.50	15.12	78,169	100,000	27.93
London City	2.80	4.56	62.87	73,677	120,000	62.87
Southampton	1.79	3.00	67.61	40,792	70,000	71.60
Norwich	0.43	0.50	16.12	23,717	30,000	26.49
<b>Sub-total</b>	<b>132.52</b>	<b>195.06</b>		<b>1,081,606</b>	<b>1,346,000</b>	
<b>South West Region</b>						
Bristol International	5.64	10.00	77.21	53,836	135,000	150.76
Bournemouth	0.89	1.25	40.91	9,288	170,000	1730.32
Exeter	0.80	1.00	25.67	13,888	135,000	872.06
Newquay	0.39	0.90	132.64	12,658	50,000	295.01
Plymouth City	0.16	0.40	153.27	8,607	145,000	1584.68
<b>Sub-total</b>	<b>7.87</b>	<b>13.55</b>		<b>98,277</b>	<b>635,000</b>	
<b>Wales Region</b>						
Cardiff	1.63	3.00	83.91	20,537	170,000	727.77
<b>Sub-total</b>	<b>1.63</b>	<b>3.00</b>		<b>20,537</b>	<b>170,000</b>	

## Available regional capacity under the CCC scenario

In the CCC's 2009 report, the "likely scenario" compatible with the 2050 target allows for substantially less growth in passengers than was estimated in the unconstrained demand forecasts and the ATWP 2003. In practice, policy measures would need to apply additional constraints on demand to deliver the emissions target. Current Government policy applies a constraint on demand in the South East that was not in place at the time of the ATWP insofar as it does not support new runways at Heathrow, Gatwick or Stansted.

In the ATWP, projected demand in each region was forecast using a number of scenarios, including unconstrained demand and a scenario that envisaged development being restricted to that which is already supported in the planning system (the "UK-wide constrained" [UKC] scenario). This assumption is similar to the basis of the original AEF assessment of available UK airport capacity. Therefore, it is reasonable to assume that a similar distribution of demand and traffic would result if no further UK capacity was provided under the CCC scenario. Other ATWP scenarios are less relevant because the distribution of traffic between the South East and other regions varies, especially under an unconstrained scenario.

While the CCC aviation target applies to 2050, the Government forecasts for demand go out to 2030 only. However, using the demand allocated to each region in the ATWP 2030 UKC scenario, the distribution of demand between regions can be expressed in terms of a percentage share for each. If these percentages are then applied to the CCC scenario, it is possible to estimate how the restricted capacity envisaged in the CCC 'likely' scenario might be distributed in practice between the UK regions.

The CCC estimated that a maximum of 3.4 million movements in 2050 would be compatible with achieving the Government's emissions target under 'likely' assumptions for biofuels, technology improvements, and modal shift, accommodating around 370 mppa (an approximate 60% increase in passengers over 2005 levels<sup>3</sup>). For the purposes of this study, a precise increase of 60% over 2005 levels is assumed. With a passenger throughput at UK airports totalling 228 mppa<sup>4</sup> in 2005, this corresponds to a projection of 364.8 mppa in 2050. Based on this total, the results produce the following regional distribution of passengers:

Region	ATWP UKC forecast in 2030 (mppa)	% of demand under UKC	Max mppa in 2050 under CCC emissions cap
Scotland	26.2	10.1	36.8
Wales	3.6	1.4	5.1
Northern Ireland	8.1	3.1	11.3
North of England	53.9	20.7	75.5
Midlands	16.1	6.2	22.6
South West	8.1	3.1	11.3
South East	144	55.4	202.1
<b>Total</b>	<b>260</b>	<b>100</b>	<b>364.7</b>

<sup>3</sup> Meeting the UK aviation target – options for reducing emissions to 2050, Committee on Climate Change, December 2009

<sup>4</sup> UK Airport Statistics [www.caa.co.uk/default.aspx?catid=80&pagetype=88&pageid=3&sqlid=3](http://www.caa.co.uk/default.aspx?catid=80&pagetype=88&pageid=3&sqlid=3), Civil Aviation Authority (CAA)



## Results by region

The table below matches the regional demand likely to arise under the CCC scenario with the terminal capacity currently available in a given region. The last column shows which regions are likely to experience a shortfall in capacity (shaded red) or have excess capacity (shaded green).

Region	2009 Pax (mppa)	Available terminal capacity (mppa)	ATWP UKC forecast in 2030 (mppa)	% of demand under UKC	Max mppa in 2050 under CCC emissions cap	Under / over provision (mppa)
Scotland	21.67	28.4	26.2	10.1	36.8	-8.4
Wales	1.63	3	3.6	1.4	5.1	-2.1
Northern Ireland	7.17	10.5	8.1	3.1	11.3	-0.8
North of England	35	59.3	53.9	20.7	75.5	-16.2
Midlands	13.76	24	16.1	6.2	22.6	1.4
South West	7.87	13.55	8.1	3.1	11.3	2.25
South East	132.52	195.05	144	55.4	202.1	-7.05
<b>Total</b>	<b>219.62</b>	<b>333.8</b>	<b>260</b>	<b>100</b>	<b>364.7</b>	<b>-30.9</b>

Overall, the results suggest a shortfall in available terminal capacity of 30.9 mppa by 2050 (although, in the interim, the available terminal capacity exists in every region, except Wales, to meet the Government's 2030 constrained scenario).

However, there is an unequal distribution between regions: both the South West and the Midlands have available terminal capacity in 2050 (suggesting that some planned developments at airports in the region may not be fully realised), while the other regions show demand (within CCC maximum levels) exceeding supply. Of these, the shortfall in the South East is relatively modest, representing 3.5% of total demand, rising to 21.5% and 22.8% in the North of England and Scotland respectively. The largest shortfall is in Wales (41.2%), although the absolute number of passengers is small by comparison with other regions.

While the regional forecasts of passenger numbers represent the total demand in a region, the available terminal capacity in a region is based solely on the airports identified in the ATWP. In many regions, there will be existing secondary airports that offer some additional capacity. This report does not advocate the use of these smaller airports, but notes that additional facilities exist at some small airports where scheduled services are provided already but which have not been included in this analysis (for example, Manston Kent International Airport).

Although the analysis of available terminal capacity was undertaken on the basis that planning permission has already been granted (or is not required by virtue of permitted development rights), some consents were in the form of outline planning permission. This raises the question of whether some developments could be regarded as speculative and may not be constructed. Given the recent economic downturn and the corresponding drop in traffic at most UK airports, some developments have been delayed. However, the analysis of regional demand suggests that demand matches supply in most regions. This is not

surprising, as most airports invest in new infrastructure only when it is required with large terminals being constructed in phases. It is probable, therefore, that most airports will proceed with these developments over time. Even at small facilities, while the growth potential (in percentage terms) can appear comparatively large compared to the low or very modest current throughput, the overall increases appear credible.

### Available runway capacity

A similar comparison can be made of air transport movements to show whether there is an under/over provision of runway capacity in each region. However, due to the different fleet mix serving each airport, it is necessary to take aircraft size into account as the average number of people carried by each aircraft varies by region as shown in the following table for traffic by region in 2009:

Region	2009 ATMs	2009 passengers (million)	Average passengers per ATM
Scotland	319,639	21.67	67.8
Wales	20,537	1.63	79.37
Northern Ireland	83,229	7.17	86.15
North of England	328,459	35	106.56
Midlands	154,356	13.76	89.14
South West	98,277	7.87	80.08
South East	1,081,606	132.52	122.52
<b>Total</b>	<b>2,086,103</b>	<b>219.62</b>	<b>105.28</b>

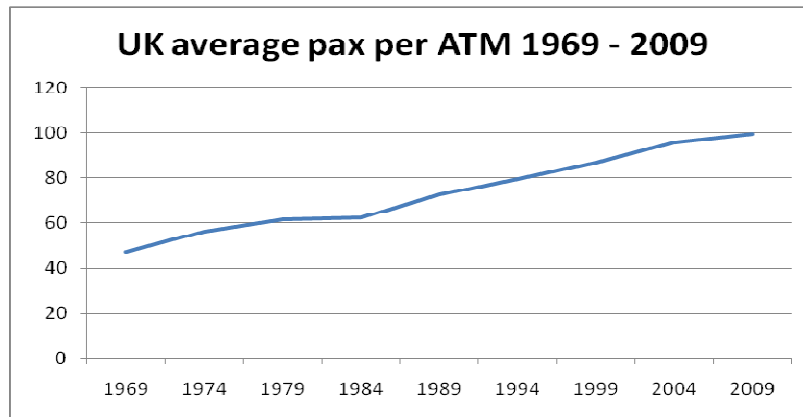
Applying these figures to the maximum number of passengers in each region under the CCC's likely scenario provides an indication of the associated number of ATMs in 2050:

Region	2009 ATMs	Max mppa in 2050 under CCC emissions cap	Average passengers per ATM (2009)	ATMs Associated with CCC emissions cap in 2050	Maximum Available ATMs	Under / over provision
Scotland	319,639	36.8	67.8	542,773	867,200	324,427
Wales	20,537	5.1	79.37	64,256	170,000	105,744
Northern Ireland	83,229	11.3	86.15	131,167	240,000	108,833
North of England	328,459	75.5	106.56	708,521	1,300,918	592,397
Midlands	154,356	22.6	89.14	253,534	389,119	135,585
South West	98,277	11.3	80.08	141,109	635,000	493,891
South East	1,081,606	202.1	122.52	1,649,527	1,346,000	-303,527
<b>Total</b>	<b>2,086,103</b>	<b>364.7</b>	<b>105.28</b>	<b>3,490,887</b>	<b>4,948,237</b>	<b>1,457,350</b>

There is a significant surplus of runway capacity available in the UK system as a whole to accommodate the number of ATMs associated with the CCC's "likely" scenario. It is notable that the estimated number of ATMs in this study correlates closely with the CCC's forecast of 3.4 million ATMs in 2050. There is a surplus in all of the UK regions except the South East. This over-capacity is sufficiently large to be likely to address concerns regarding the ability of some individual airports to fully utilise their available capacity (for example, airports in close proximity to each other may find it difficult to increase flights beyond a certain level due to airspace limitations).

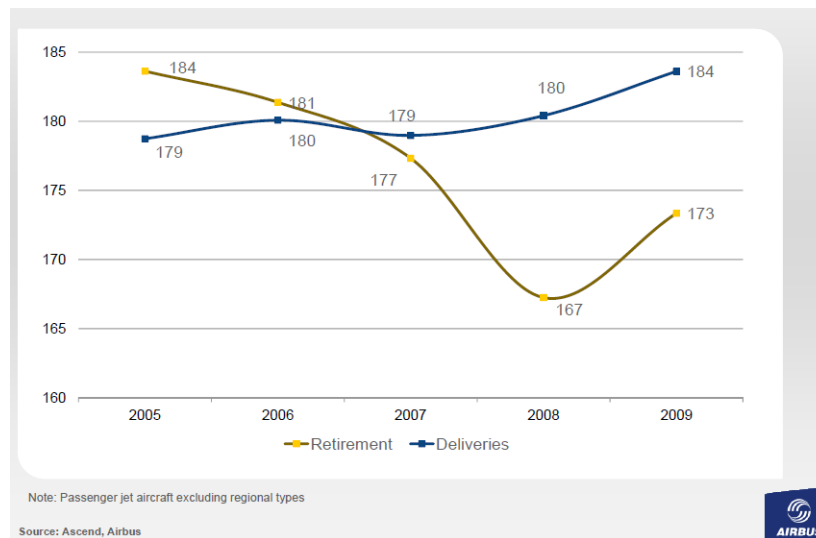
Despite the average number of passengers per ATM at South East airports being significantly higher than the national average (at Heathrow it reaches 143.21), there is an implied shortfall of runway capacity in the region.

The CCC noted that the 60% increase in passenger numbers would require “increasing load factors over time” (although, viewed nationally, its figures of 370mppa from 3.4million ATMs assumes an average passenger load of just 108.82, showing little change from today’s level). In practice, the average number of passengers per ATM has increased steadily over the last 40 years and is likely to continue to do so:



Source: CAA Airport Statistics

There is no evidence to support the assumption the average number of passengers per ATM will remain constant in the future. Today, new aircraft deliveries continue to be larger than those they replace, as shown in the following Airbus graph:



Furthermore, Boeing states:

“The average seat count of airplanes in the fleet will verge upward incrementally as fuel and operating cost pressures encourage airlines to go to larger seat counts within all airplane size categories. In particular, due to better economics, small regional jets will be replaced with larger RJs and small single-aisle airplanes on short-haul routes. Introduction of the 787 and, eventually, the A350 will spur airlines to trade up as airplanes in the 767 and A330 size category begin to reach retirement age. Within the large airplane segment, airlines will look to upgauge from the 747-400 to the 747-8 or A380”<sup>5</sup>.

Specifically, at Stansted, Easyjet has announced plans to convert its A319 options (with a capacity of between 120-160 seats) to A320s (with a capacity between 150-180).

In fact, the trend towards more passengers per ATM is more likely to continue in the South East region if capacity is restricted. The DfT’s 2007 demand forecasts note *“The Demand Reallocation Routine tests for breaches of both runway and terminal capacity. The effects of runway and terminal shadow costs tend to differ. As the shadow cost is ultimately added to the individual passenger’s overall cost of travel, a runway constraint will stimulate the use of larger aircraft and higher passenger loads (to help airlines meet demand and because the charge levied on the use of the runway is lower on a per passenger basis for heavier loaded aircraft)”*. For example, Heathrow will be required to achieve an average passenger loading of 197.92 per aircraft if it is to grow to 95mppa with only 480,000 permitted ATMs (considered by BAA to be realistic with, amongst other factors, the introduction of the A380<sup>6</sup>). As the average at Heathrow in 2009 was 143.21, this represents a projected increase of 38% compared with the situation today.

Assuming that Heathrow does achieve a throughput of 95 mppa from 480,000 ATMs, the residual demand in the South East (107.2 mppa) could be accommodated by the runway capacity available today, if there is an increase in the number of passengers per ATM of just 15%. The average pax/ATM in the SE (including Heathrow) is currently 122.52, but falls to 107.14 if you take Heathrow out of the equation. A 15% increase in this figure (to just over 123) over the next 40 years would require 869,241 ATMs to meet residual demand. Factoring in the 480,000 ATMs at Heathrow, the total ATM requirement for the SE region in 2050 is 1.349 million ATMs compared with an available 1.346 million, as shown in the following table:

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<sup>5</sup> Current Market Outlook 2010-29, Boeing [www.boeing.com/commercial/cmo/index.html](http://www.boeing.com/commercial/cmo/index.html)

<sup>6</sup> Heathrow Airport, Interim Master Plan, BAA Heathrow, 2005  
<http://www.baa.com/assets/B2CPortal/Static%20Files/LHRInterimMasterPlan.pdf>

Region	2009 ATMs	Max mppa in 2050 under CCC emissions cap	Average passengers per ATM (2009)	ATMs Associated with CCC emissions cap in 2050	Maximum Available ATMs	Under / over provision
Scotland	319,639	36.8	67.8	542,773	867,200	324,427
Wales	20,537	5.1	79.37	64,256	170,000	105,744
Northern Ireland	83,229	11.3	86.15	131,167	240,000	108,833
North of England	328,459	75.5	106.56	708,521	1,300,918	592,397
Midlands	154,356	22.6	89.14	253,534	389,119	135,585
South West	98,277	11.3	80.08	141,109	635,000	493,891
South East (adjusted)	1,081,606	202.1	198 / 123 *	1,349,000	1,346,000	-3,000
<b>Total</b>	<b>2,086,103</b>	<b>364.7</b>	<b>105.28</b>	<b>3,190,360</b>	<b>4,948,237</b>	<b>1,757,877</b>

Coupled with the available capacity at other South East airports not included in this assessment (and subject to the same caveats applied to terminal capacity at these airports), any argument for the need for additional runway capacity becomes less compelling.

While some may argue that the move to larger aircraft produces surplus runway capacity that could be utilised by more aircraft, this is unlikely to be feasible under the CCC scenario. The figure of 3.4 million ATMs is derived from the amount of carbon dioxide available to the sector in 2050, a maximum of 37.5 MtCO<sub>2</sub>, and assumes a similar fleet mix throughout the period 2005-2050. The CCC has acknowledged that a change in the fleet mix would have a corresponding impact on the number of passengers and aircraft movements that can be accommodated within the 2050 target. If aircraft size (and weight) increases so will the associated CO<sub>2</sub> emissions per aircraft, reducing the number of ATMs that would be consistent with the CCC scenario. Consequently, this would reduce the runway capacity requirements in each region although an accurate assessment of this effect would require detailed modelling. By increasing aircraft size (or load factors) in the South East as shown above, the total number of UK-wide ATMs associated with the CCC's target would fall to 3.19 million.

### Sensitivity Analysis

Since publication of the ATWP, the Department for Transport has published a progress report on the ATWP (2006)<sup>7</sup> and two subsequent passenger and CO<sub>2</sub> forecasts (2007<sup>8</sup> and 2009<sup>9</sup>). All three documents updated the forecasts of the future demand for passenger air travel in the UK. The 2006 Progress Report noted that the ATWP forecasts had proven to be accurate to date and that the updated forecasts remain in line with the original projection. However, the results of the National Airport Allocation model for each region were not made available.

The DfT's 2007 report was a technical note providing more detail on the forecasts underpinning the Progress Report. This report developed several constrained capacity scenarios, notably: S01 – the planning case with no capacity beyond that already in the

<sup>7</sup> The Future of Air Transport Progress Report, DfT, 2006

<sup>8</sup> UK Air Passenger Demand and Carbon Dioxide Forecasts, DfT, November 2007

<http://webarchive.nationalarchives.gov.uk/+http://www.dft.gov.uk/pgr/aviation/atf/ukairdemandandco2forecasts/>

<sup>9</sup> UK Air Passenger Demand and CO<sub>2</sub> Forecasts, DfT, January 2009 [www.dft.gov.uk/pgr/aviation/atf/co2forecasts09/](http://www.dft.gov.uk/pgr/aviation/atf/co2forecasts09/)

planning system at South East airports, and S02 – making maximum use of existing airport infrastructure (the planning case plus developments at Stansted to 241,000 ATMs from 2015 and Luton to 135,000 ATMs from 2015). The remaining six scenarios envisaged additional runways at either Stansted or Heathrow, or both. Given the Government’s approval of the application to allow Stansted to expand to its maximum use, scenario S02 provides the closest fit to the assumption used in this report (albeit that it does not envisage any constraint at regional airports). Scenario S02 estimates terminal capacity in the South East in 2030 to be 190 mppa. This provides a good correlation with AEF’s assessment, which estimated 195 mppa (taking into account that the “region” used in the AEF analysis included Southampton Airport and the East of England (Norwich Airport)). In relation to movements, S02 estimates 1,207,000 ATMs in 2030 in the South East (compared to AEF’s assessment of 1,346,000). Detailed regional breakdowns for airports outside of the SE are not provided, although the central reference case for constrained growth shows approximately 58% of demand in the South East, compared to AEF’s analysis based on the ATWP figure, which showed 55.4%.

The 2009 forecasts updated the 2007 assessment. The methodology remained unchanged, but the results showed a slower rate of growth. In the forecast, scenario S01 was amended to include the planning consents for London City Airport to increase to 120,000 ATMs per annum and Stansted to 35 mppa and 259,000 ATMs. Consequently, S02 was also amended to reflect these changes and to add a terminal increase of 6 mppa at Gatwick. S02 shows the South East accommodating 1,254,000 ATMs and 193mppa in 2030 (providing an even closer correlation with the AEF’s assessment). The central reference scenario estimates 55% of demand being accommodated in the South East region.

### Conclusions and policy issues for further consideration

Given the Government’s policy not to build additional runways at Heathrow, Gatwick or Stansted, it is likely that the industry will respond to a lack of available slots by deploying larger aircraft on some routes, especially those originating in the South East. This will have the effect of reducing the number of ATMs consistent with the need to keep emissions from the UK aviation sector at or below 37.5MtCO<sub>2</sub> by 2050. In these circumstances, it is plausible to suggest that available runway and terminal capacity (either in place today, or for which planning permission has been granted or is available under permitted development rights) exists in the majority of cases, with the exception of terminal capacity in Scotland and the North of England.

This further suggests that the Government is right to pursue its “better not bigger” agenda in the South East, that a new Thames Estuary airport is not justified on capacity grounds, and that a cautious approach is required to development at regional airports (especially if the aviation target is subsequently tightened to take account of non-CO<sub>2</sub> effects). Although AEF would recommend a detailed assessment of regional demand under the CCC’s “likely” scenario, the results of this analysis show that on climate change grounds alone very few additional airport developments can be justified.

Furthermore, the analysis assumes that there is little shift in travel behaviour, despite improved telecommunications. The CCC noted some shift towards video-conferencing but

concluded “There is uncertainty over scope for substitution of videoconferencing for business travel. We reflect this in a conservative range from very limited substitution to a reduction of 30% in business demand in 2050”. A more ambitious approach to promoting videoconferencing could help to address some of the constraints identified in this report.

This report and the conclusions below assume that UK aviation is permitted to grow to the maximum level compatible with an aviation emissions cap of 37.5 MtCO<sub>2</sub> and any references to necessary additional capacity should be understood only in this context. AEF believes that it is essential for UK aviation policy to be compatible with UK climate policy. The commissioning of the CCC report of December 2009 indicated that the Government was beginning to consider how this could be achieved. However, AEF has a number of concerns about the cap that we expressed when it was announced including the fact that it takes 2005 as a starting point (rather than 1990, used in wider climate policy), does not account for non-CO<sub>2</sub> impacts, and sets no interim goals. Furthermore, the current Government has so far not confirmed whether it supports a policy of capping UK aviation emissions. Until these issues are resolved, combined with the need for a thorough assessment of the local environmental implications, AEF advocates a moratorium on any aviation expansion.

### **Regional Overview - the South East**

The above analysis demonstrates how an increase in aircraft size could eliminate the projected shortfall in available runway capacity without the need for new runways or an end to runway alternation at Heathrow. The comparatively small shortfall in available terminal capacity could be addressed by taking into account other South East airports not included in this study, or through better utilisation of existing facilities or the promotion of rail for domestic routes. As reported in the media, consideration of differential charging in such as higher rates of Air Passenger Duty for departures from South East airports could also increase the use of regional airports. However, the scenario assessed in this report is based on a constrained South East airport system, so the distributional effects of such an approach are likely to be similar to those identified in this report. The main difference is that a higher rate of APD may accelerate the rate at which passenger demand switches.

In relation to the retention of Heathrow as a major hub airport, BAA figures claim that Heathrow could handle a 44% increase in passenger numbers over 2009 levels. Industry sources estimate that approximately one third of Heathrow’s passengers are making connecting flights. There is scope for the absolute number of transfer passengers to increase in the future although its ability to do so is influenced as much by the present planning conditions and Government position on a third runway as it is by the CCC’s 2050 target.

### **Regional Overview - the South West**

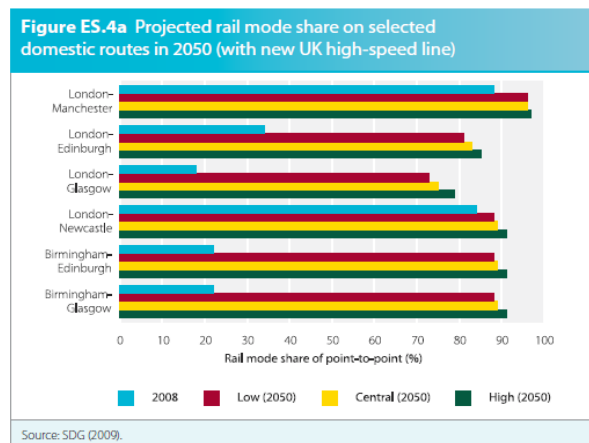
The South West has considerable available terminal capacity today and this analysis suggests that it will still have over 15% excess capacity by 2050. This would imply that a different distribution of traffic to the region (for example, as a result of measures to encourage demand outside of the South East) could still be accommodated without the provision of further terminal capacity. Available runway capacity in the region is not a limiting factor.

## Regional Overview - the Midlands

Although available terminal capacity today will support an increase of 10mppa, the majority of this will have been utilised by 2050, leaving a surplus of just 1.4mppa. While this is sufficient to accommodate regional demand under the 2050 target, the Midlands could be sensitive to the development of High Speed 2 (HS2). Once operational, high speed connections from the South East and North West of England to Birmingham could make the airport very attractive for people in these regions wanting to make international flights, especially if travel times by train are under an hour and a direct connection is made to the airport. Available runway capacity in the Midlands is not a limiting factor.

## Regional Overview - the North of England

While available runway capacity is not a constraining factor, either now or in 2050, it is estimated that there will be a considerable shortfall in available terminal capacity to serve the North of England by 2050 if demand grows to the maximum permitted level under the emissions cap. The future contribution of high speed rail to modal substitution away from air has already been factored into the CCC's scenarios. While there is considerable scope to replace domestic services generally, the region's principal airport, Manchester, has less potential as rail use for journeys to and from London is already high as shown below (source CCC, 2009):



A more aggressive Government policy towards promoting rail and encouraging state of the art videoconferencing facilities may help in alleviating some of the projected shortfall in available terminal capacity.

## Regional Overview - Scotland

Like the North of England, Scotland has available runway capacity under the CCC's likely 2050 scenario but is projected to have a shortfall of just over 8mppa in terms of available terminal capacity. However, unlike the North region, Scotland stands to gain more from a switch of domestic air services to rail, and there is scope to go beyond the CCC's scenario: a policy which discouraged trips by air on routes where high speed rail competed could see



rail's modal share go further than the 73% and 82% predicted for the London-Glasgow and London-Edinburgh routes respectively.

### Regional Overview – Wales

Wales appears to have a significant shortfall, with available capacity totalling around 40% of projected demand by 2050. However, the absolute numbers are small, representing just over 2m ppa per annum. Promoting rail, with access to nearby airports such as Birmingham and Bristol, could contribute to meeting regional demand in the future. Runway capacity is not a constraining factor.

### Regional Overview – Northern Ireland

Northern Ireland has significant runway capacity available but is likely to experience a modest shortfall in available terminal capacity by 2050. While modal substitution is not a viable option for the region, significant airport expansion would not be required to accommodate an extra 0.8m ppa.

### Timing

This report assesses capacity in 2005 and 2050 but has not looked at any years in between. The following table illustrates when each region may reach capacity assuming different annual growth rates. A growth rate of 1-2% per annum provides for steady growth out to 2050 in most regions. Given that the annual rate of efficiency improvement across the aviation sector – historically also around 1-2% per annum – is relatively homogenous, keeping the rate of aviation growth to this level will help to ensure that emissions from the aviation sector remain close to the 2005 level. However, Government measures are required now to achieve this as historically the sector has grown at around 5% per annum.

Region	2009 Pax (m ppa)	Available terminal capacity (m ppa)	Year when region reaches capacity		
<b>Increase in demand p.a.</b>			<b>1%</b>	<b>3%</b>	<b>5%</b>
Scotland	21.67	28.4	2037	2019	2015
Wales	1.63	3	2070	2030	2022
Northern Ireland	7.17	10.5	2047	2022	2017
North of England	35	59.3	2062	2027	2020
Midlands	13.76	24	2065	2028	2021
South West	7.87	13.55	2063	2027	2021
South East	132.52	195.05	2048	2023	2017
<b>Total</b>	<b>219.62</b>	<b>333.8</b>	<b>2051</b>	<b>2024</b>	<b>2018</b>

## Appendix A – Notes on airport capacity

Airport	Comments
<b>Heathrow</b>	Heathrow's movements are limited to 480,000 by a planning condition. At the Terminal 5 inquiry, it was stated that T5 would have a capacity of 30mppa, taking the airport's total capacity to 90mppa. However, with a move to larger aircraft, it is estimated that Heathrow could handle 95mppa. Terminal 2 is currently being rebuilt and has an estimated capacity of 30mppa. Terminal 1 is due to be rebuilt starting in 2015/6.
<b>Gatwick</b>	Passenger capacity assumes full utilisation of off-peak slots and larger aircraft. Gatwick's single runway is already close to capacity. To achieve 46.5mppa, average load factors would need to increase from around 131 to 166.
<b>Stansted</b>	Both max ATMs and max mppa were defined by planning permission in October 2008.
<b>Manchester</b>	The current terminals have a capacity of 23 mppa but the ATWP existing planning consents and permitted development rights could increase the figure to 35mppa, according to the ATWP. Max ATMs are estimated by the ATWP to be 330,000, associated with a throughput of 35mppa, although the runways could accommodate a maximum of 440,000.
<b>Luton</b>	The ATWP estimated Luton's current terminal and runway capacity to be 10mppa and 100,000 ATMs respectively. However, in 2008, Luton handled 10.18mppa. On this basis a figure of 10.5mppa has been used.
<b>Birmingham</b>	There is an ATM limit of 204,000 as defined by a planning condition. The ATWP defines the terminal capacity as 12.3 mppa. Since the ATWP, a new pier has been added and the airport has started work on combining terminals 1 and 2. In a planning document to the LPA, the airport estimates the resulting terminal capacity to be 17-19mppa (the mid-point is used in this analysis). At this level, without a runway extension, the airport estimates the associated runway usage to be 169,119 ATMs.
<b>Edinburgh</b>	The ATM figure is based on the ATWP. The BAA Edinburgh website states that new terminal improvements underway will take the terminal capacity to 13mppa.
<b>Glasgow</b>	Both the terminal and runway capacity figures are taken from the ATWP. Glasgow is about to open a refurbishment programme with some terminal expansion but no information is available on the revised capacity.
<b>Bristol International</b>	Planning permission for an increase in terminal capacity to 10mppa has been granted subject Secretary of State approval. The ATWP estimated runway capacity to be between 135-160,000 ATMs. However, without a significant increase in average load factors (already at over 104 pax per movement), the capacity associated with terminal throughput of 10mppa is likely to be much lower.
<b>Liverpool John Lennon</b>	The airport master plan suggests that 6 mppa would be the maximum capacity within existing planning permission, although recently approved improvements have increased the floorspace marginally and could potentially increase capacity by up to 0.5mppa.

<b>Nottingham East Midlands</b>	Although the ATWP estimates the airport's terminal capacity to be 4.5mppa, it has been operating above this limit for several years. Several websites providing technical data on airports suggest the capacity is now 6mppa. The ATWP estimated runway capacity at 220,000. Planning approval recently granted for a runway extension was accompanied by a night noise condition which could significantly reduce the total ATM capacity, but no figures reflecting this possible impact are currently available.
<b>Newcastle</b>	Terminal capacity is defined by the airport's master plan as 4.8mppa but the ATWP estimates it to be closer to 6mppa with improvements under permitted development rights. The ATWP estimates the runway capacity to be 165,000 ATMs.
<b>Belfast International</b>	The 6.5 mppa figure is from the ATWP assuming some terminal enhancements for which outline permission had been granted. There have been no significant changes to terminal capacity since 1998.
<b>Aberdeen</b>	Terminal enhancements are being sought which may raise capacity. The ATWP estimated the runway capacity to be 146,000 ATMs per annum. Since this date, the operator has been granted a runway extension and made other improvements which it states could increase the handling capacity by 20%. Available apron capacity (2.5 mppa) is lower than terminal capacity, but is not considered to be a constraining factor as improvements are usually possible under permitted development rights.
<b>London City</b>	ATM figure is based on a 2009 planning approval. There is little scope to increase the average aircraft size at this airport due to runway constraints.
<b>Blackpool</b>	There are no limitations on the use of the runway.
<b>Belfast City</b>	ATMs are limited by a planning agreement. The same agreement also stipulated that a maximum of 2,000,000 seats can be sold for flights FROM the airport. On this basis, the capacity is equivalent to 4mppa for arriving and departing passengers. Although the infrastructure may not be available today, it is unlikely that planning permission would be refused up to this limit.
<b>Leeds Bradford</b>	The ATWP estimates the terminal capacity to be 2.5-3mppa. Approval has since been granted for a terminal extension with an additional floorspace of 4452sqm. This implies an additional capacity of approximately 0.75 mppa using the formula of 1mppa per 6000sq m. The ATWP estimates runway capacity to be 167,000.
<b>Glasgow Prestwick</b>	While the ATWP estimates the airport's terminal capacity to be 2mppa, the airport website states the capacity is now 3mppa. The ATWP estimates runway capacity to be 186,000 ATMs.
<b>Southampton</b>	The airport estimates that the current terminal, with some improvement, is capable of handling 3mppa (Source: BAA Southampton website).
<b>Cardiff</b>	The ATWP estimated the capacity of the terminal to be 3mppa. Although the airport believes that reorganisation of services, and "modest extensions" within the terminal could lead to a capacity of 8mppa by 2030, the planning permissions for terminal enhancements since the ATWP will not, the airport suggests, affect capacity (indicating 3mppa).

<b>Bournemouth</b>	The runway is estimated to be capable of handling 170,000 ATMs per annum.
<b>Robin Hood Doncaster Sheffield</b>	The application to convert RAF Finningley to a civilian airport was based on the construction of a terminal to handle up to 2.3mppa. The subsequent planning decision placed the following limits on movements: until the end of 2011, total maximum ATMs 44,571, of which max passenger ATMs 22,419 and max cargo ATMs 3596 (the rest made up of GA and maintenance); from 2012 total maximum ATMs 56,918, of which max passenger ATMs 27,799 and max cargo ATMs 4140.
<b>Exeter</b>	The ATWP's estimated terminal capacity was 0.9mppa, but this was exceeded in 2007. The ATWP estimates runway capacity to be 135-160,000 ATMs.
<b>Inverness</b>	The airport master plan estimates that the current terminal can handle 0.9mppa. Plans have been submitted to increase this to 1.5mppa by 2010 but have yet to be approved.
<b>Norwich</b>	The planning consent for the terminal specifies that the size should not exceed 39,000 sq feet, or 3,623 sq meters. The "accepted figure" is 6,000 sq metres per 1mppa. On this basis, the capacity at Norwich is unlikely to exceed 500,000.
<b>Newquay</b>	Figures are based on the ATWP.
<b>Humberside</b>	The airport master plan states the terminal capacity is 0.75mppa. The ATWP estimate of runway capacity is 199,000 ATMs.
<b>Teesside</b>	Following a recent refurbishment, the airport operator estimates the terminal capacity to be 3mppa.
<b>Plymouth City</b>	The ATWP estimates terminal capacity of 0.4mppa and runway capacity of 145-160,000 ATMs. Larger aircraft are limited by the short runway.