

ASSESSMENT SUMMARY

Criterion	Constituency	Impact relative to current situation				
		++ve	+ve	Neutral	-ve	--ve
Strategic fit				tbc		
Economy	Airport					
	Airlines					
	Passengers					
	Connectivity					
	Employment					
	Public accounts					
Surface access	Road access capacity					
	Rail capacity					
	Journey time					
Environment	Noise					
	Air quality					
	Climate change					
People	Employment					
	Housing & demolition					
	Vulnerable groups					
	Quality of life					
	Social impacts					
Costs	Capital					
	Operating					
	Surface access					
Operational	Resilience					
	Efficiency (delay)					
	Reliability					
	Passenger experience					
	Safety					
	Scalability					
	Airspace					
Delivery	Timescales					
	Technical & operational risk					
	Planning risk					

ASSESSMENT RESULTS

Summary	This package has significantly beneficial impacts on Heathrow's resilience above and beyond the core package, but does so at the cost of public acceptability. The most significant element of this package has been referred to by some third party submissions as "resilience mixed mode" which would involve the use of both runways for arrivals and departures. Some of the public acceptability risks of this package might be offset by some components of the maximum mitigation package.
Strategic fit	Introducing full mixed mode at Heathrow within the existing capacity cap would significantly enhance the reliability and resilience of the airport, reducing delays and cancellations for airlines and airline customers and increasing the overall quality of service to users. This would support Heathrow being a better airport, which would attract airline passengers because of the reliability of service and reduced delays, making it highly competitive on these measures with other major hub airports. However, reducing the capacity declaration at both Heathrow and Gatwick will result in future growth being constrained, with only some additional demand being accommodated by services at other airports or with larger aircraft on some flights where this may be viable. This package will result in worthwhile savings in time for existing users of Heathrow and Gatwick (and operational savings for airlines at both airports), but will increasingly be offset by higher fares due to demand continuing to be constrained by the ability of airlines to supply capacity within the caps and the inability of new market entry to be established at either Heathrow or Gatwick. This may reduce connectivity over the longer term, as it will result in airlines focusing existing capacity on highest yielding services, which may see a continuing trend of reduced domestic and short-haul services, and increased frequencies on established long-haul routes.
Economy	Net NPV of £3.3B (2014-2030) compared with the status quo ¹ , an increase in NPV of nearly £0.7B compared with the core package, largely due to reduced airline operating costs and reduced delays and cancellations for airlines and airline passengers. The introduction of reduced capacity declarations at Heathrow and Gatwick would have a negligible negative impact on airlines that wish to introduce or increase services, consumers and connectivity. Incumbent airlines at Heathrow and Gatwick will see increases in the values of their existing slot pairs due to increased scarcity.
Surface Transport	Negligible impacts compared to the core package.
Environment	There is an increased environmental benefit from this package compared to the core package. Air quality emissions are reduced further compared to the core and status quo, and carbon emissions deliver only 7.83Mt savings from 2014 to 2030, showing an NPV of £172.2M costed on a central scenario of traded carbon prices (compared to 7.12Mt CO ₂ and £147.9 NPV for the core). The resilience measures will not create any additional noise energy in total, but will redistribute noise in time and space, and is likely to be perceived as a negative noise impact regardless of technical measurement. The overall effect on the noise contour area and the number of people affected will be as per core package.
People	Negligible impacts compared to the core package
Cost	Negligible impacts compared to the core package
Operational Viability	Reduced capacity declaration at Heathrow likely to result in only one less flight per day over a 10 year period, as demand is unlikely to see capacity surrendered.
Delivery	Significant planning barriers to introducing mixed mode and need for regulatory measures to manage business and general aviation from Heathrow and Gatwick

¹ The 'status quo' means current operations using a baseline of 2008 data.

ECONOMIC IMPACTS

Impact on Industry (summary commentary)

These measures will reduce costs for airlines and delays for airlines and airline passengers, delivering net economic benefits of around **£3.3B (NPV)** by 2030 for the aviation sector and its users, including the value of the core package. This is **£0.7B (NPV)** higher than the core package or **£62M per annum** on average. Compared to the core package, the primary impact of the maximum resilience package on the aviation industry will be at Heathrow, but it would also have benefits in protecting the existing levels of reliability at Gatwick. Heathrow Airport, and its airline and passenger customers, will experience the greatest impact, primarily because the existing resilience issues and frequency and severity of delays are most critical at Heathrow, and the effects of introducing full mixed mode for resilience will be to provide sufficient capacity to reduce average airborne delays by 68%-83%, and ground delays by 29%-32%. These deliver benefits to airlines from time savings (saving crew time), fuel savings, reduced cancellation costs and in the longer term, due to reduced schedule blocks, long term capital savings due to better fleet utilisation. Longer term, there is an unquantified benefit for Heathrow and the airlines using it from delivering a higher quality experience for users, that could equal or exceed that of other competing hub airports. This may attract increased numbers of higher yielding passengers who are now attracted to the airport (for point-to-point and transfer purposes) because of these improvements. However, a long term cap on flights at Gatwick and a lowering of the capacity declaration at Heathrow, will see some future capacity forgone in favour of enhanced resilience for those flights that remain, resulting in a loss of benefits for some passengers, and increased pressure on fares at both airports.

Airports	Heathrow Airport will benefit indirectly from its users experiencing significantly fewer cancellations and shorter delays due to resilience issues, and so being likely to attract incremental increases in passengers due to improvements in the perceived quality of experience from using Heathrow both as a point-to-point and as a hub airport. However, Heathrow would also lose a minor amount of flight traffic (average 4.9 flights per day) from a prohibition on business/general aviation traffic. Gatwick would lose on average 5.7 flights per day from such a prohibition. This prohibition will likely benefit Stansted, Luton, Biggin Hill, Farnborough and other smaller airports across the London airport catchment area. With Gatwick Airport's capacity capped broadly at current levels, it is likely to see future growth driven primarily by larger aircraft rather than additional flights. Stansted and Luton Airports are likely to benefit from the lower capacity cap at Gatwick (and reduced capacity declaration at Heathrow), as some airlines resort to expanding services at those airports. Heathrow is likely to experience growth driven primarily by some airlines increasing the size of aircraft operated to the airport, where viable.
Airlines	Compared to the core package, the maximum resilience package will deliver quantifiable airline cost savings (2014 to 2030) of: £403M NPV primarily due to reduced delays (higher efficiency). Airlines at Heathrow and Gatwick will also experience increases in the value of their existing slot pairs due to the proposed reduced capacity declaration for Heathrow and cap on Gatwick. Given the improved passenger experience for flights at Heathrow, there may be incremental increases in demand from point-to-point and transit passengers, encouraging airlines to increase fares and/or capacity on existing services. However, airlines will continue to have to choose to cancel or reduce frequencies on existing routes to introduce new routes or increase frequencies on other routes. Airlines seeking to expand at Gatwick will have to choose to forgo further expansion or introduce new services at other London area airports. The latter option is more likely to be undertaken by low cost and charter carriers.
Passengers	Compared to the core package, the maximum resilience package will deliver incremental additional quantifiable passenger cost savings (2014 to 2030) of £244M NPV primarily due to reduced delays at Heathrow. These measures will also deliver unquantified benefits by foregoing growth in delays at Gatwick. However, the reduced capacity declaration at Heathrow is expected to have a modest cost of around £9M NPV due to the forecast reduction over time of up to two daily flights by 2030. Passengers will experience unquantified improvements in the overall passenger experience at Heathrow, due to substantially improved reliability, but given likely increased demand to use Heathrow, fares for flights at Heathrow, particularly on routes not offered at other airports, are likely to increase, pricing some users off of those services, deferring some trips.

DfT WebTAG Impacts (summary commentary)

- Economic Surplus Producers: Compared to the core package, at least **£403M NPV** due to improved efficiencies, reduced fuel consumption, reduced labour costs, reduced costs of delay and improved resource allocation
- Economic Surplus Passengers: **£244M NPV** incremental benefits to passengers due to reduced travel times and reduced airfares due to increased efficiencies, but offset by marginal loss of capacity of **£9M NPV** at Heathrow alone
- Time Savings From Delay Reduction: Likely to be worthwhile, but not calculated relative to core package
- Public Accounts: Negligible impact on public accounts, likely to be neutral as reduced capacity at Heathrow and Gatwick constraining future growth may be offset by a higher proportion of premium passengers subject to higher APD because of the superior airport experience at Heathrow.
- Wider Impacts And Regeneration: (See National Economic Impacts, Local & Regional Economic Impacts).
- Surface Access Impacts: Nil

User benefits

Significantly reduced delays and cancellations; improved resilience.

**Externalities
(e.g. noise & CO₂)**

The benefits of this package are of a similar order, although slightly higher than the core package. Based on the central scenario of traded CO₂ values² over the period 2014 to 2030, savings are indicated equivalent to approximately **£172.2M NPV**. Noise cost benefits have not been quantified. Respite will be lost in the mixed mode scenario at Heathrow and will be impinged on by operational freedoms prior to mixed mode being implemented.

Connectivity to domestic markets (summary commentary)

Introducing mixed mode for resilience will have a negligible positive impact on connectivity to domestic markets due to reduced travel times and increased reliability, but this may be offset by continued pressures on capacity which could result in usage of existing slots for other routes.

**International
connectivity (interline
vs. point-to-point;
market access)**

Increased reliability will improve international connectivity marginally due to reduced travel times and likely improvements to viability of existing services (and increases in aircraft size for some routes that can support it), but this is likely to be constrained by increased capacity caps for Heathrow and Gatwick which will marginally reduce international connectivity over time.

**Domestic connectivity
(surface transport &
domestic aviation)**

Negligible impacts are expected from measures that primarily support enhanced resilience and reliability of existing airports

National Economic Impacts (summary)

Compared to the core package, the maximum resilience package will produce substantial savings in operating costs for airlines and time-savings for passengers that will contribute to improved productivity. There will also be an incremental improvement in perceptions of the quality of connectivity to the UK via Heathrow, because of high standards of airport reliability, which will incrementally increase demand to use Heathrow for point-to-point and transfer traffic, although this will be constrained by continued pressures on capacity (incrementally increased with this package at both Heathrow and Gatwick). Slightly higher fares are likely over time due to the marginally increased capacity constraints at Heathrow and Gatwick, particularly for services to destinations outside Europe, because of the commercial preference of long haul airlines to operate to those airports, as increasing demand sees airlines raise fares due to limited opportunities to increase flight capacity. There will be wider impacts on the perception of the UK internationally, as its major airports may be increasingly seen as providing world class standards of reliability and resilience (albeit with higher fares over time).

Local & Regional Economic Impacts (summary)

- Support to trade: Longer term improvements to resilience and reliability at Heathrow are likely to support perceptions of improved quality of connectivity and support growth in demand. However, increased constraints on capacity are likely to influence higher fares over time, itself constraining the ability of Heathrow and Gatwick to support increased trade, tourism and investment.
- Creation of new industries: Negligible impact.
- Land Impact: Negligible impact
- Direct Employment: Incremental improvements to airline productivity due to enhanced resilience and reduced delays will support growth of demand for airlines based at Heathrow to the extent possible within capacity constraints. However, new capacity constraints at Gatwick and Heathrow will temper the likely investment by airlines in expanding at both airports, in favour of yield enhancement.
- Indirect Employment: Negligible impacts due to improved productivity, but reduced available capacity at Heathrow and Gatwick will constrain longer term growth in inbound tourism, particularly from locations outside Europe.
- Induced Employment: Negligible impacts
- Catalytic Employment: Negligible impacts
- Agglomeration Impacts: Significantly improved resilience at Heathrow Airport will incrementally support the

² <https://www.gov.uk/carbon-valuation>

agglomeration effects of industries currently supported by connectivity due to Heathrow, although this will be offset by increased constraints on capacity and their influence on fares and availability of flights. It is likely to particularly support logistics based industries due to improved trip reliability.

- Residual Value: Not relevant

ENVIRONMENT

Noise

This package will result in similar noise impacts to the core package. The resilience measures will not create any additional noise energy but will redistribute noise in time and space³. The overall effect on the noise contour area and the number of people affected will be as per the core package. Whilst a reduced capacity declaration is seen as positive the introduction of mixed mode is seen as strongly negative as people will be affected differently with some experiencing significant increases. Furthermore there is some expectation amongst the public that night activity will be reduced so maintaining the current regime may be negatively received. Modernisation of the fleet is not expected to change this outcome.

Local air quality

This package offers significantly improved reductions in NO_x compared to the core package (6,850 tonnes). Quantitative analysis indicates savings of approximately **17,550 tonnes** of NO_x at Heathrow over the period 2014 to 2030⁴, compared to the status quo based on 2008 operations and performance, extrapolated to 2030 taking into account fleet changes.

Compared to the core package, this additional benefit is delivered by

- reduction in separation between SIDs: saving 165 tonnes per year, starting in 2016 until the onset of mixed mode in 2019
- reduced departure delays due to mixed mode: saving 1060 tonnes per year.

Climate change

This package offers some improvement to the volume of CO₂ savings identified within the core package (7.12Mt).

Quantitative analysis indicates savings from this package of approximately **7.83M** tonnes of CO₂ over the period 2014 to 2030⁵, compared to the *status quo* based on 2008 operations and performance, extrapolated to 2030 taking into account fleet changes.

Compared to the core package, this additional benefit is delivered at Heathrow by:

- mixed mode³: delivering reduced delays resulting in 260,000 tonnes per year
- operational freedoms followed by mixed mode³: reducing delays associated with the increase in proportion of A380s in the fleet mix of thereby reducing CO₂ emissions by an average of approximately 95,000 tonnes per year.

³ Revised Future Aircraft Noise Exposure Estimates for Heathrow Airport

<http://www.caa.co.uk/application.aspx?catid=33&pagetype=65&appid=11&mode=detail&id=4979>

⁴ LeighFisher analysis has estimated delay and NO_x benefits from a relationship to CO₂, derived from estimates of fuel burn generated using the ground holding delay models developed in the CAA runway resilience study

(http://www.caa.co.uk/docs/589/ICF_runway_resilience_final_report_16Feb09.pdf) augmented by emissions predictions generated using the ICAO Aircraft Engine Emissions Databank and the Eurocontrol BADA (Base of Aircraft Data), <http://www.eurocontrol.int/services/bada>

⁵ Carbon impact calculated from estimated fuel savings, using emission factor for Jet A1: <http://www.ukconversionfactorscarbonsmart.co.uk/>

PEOPLE

Employment

No significant impacts on employment are anticipated from deployment of the maximum resilience package, although the support given to the aviation industry will reduce the likelihood of workforce reductions, and an increased focus on quality and yield of airport passengers at Heathrow in particular may marginally support increases in employment.

Improved efficiencies in the airline sector will make an incremental contribution to maintaining and growing the aviation sector in the UK. The longer term impacts of improved resilience and reliability of major airports will have an incremental effect upon perceptions of quality of connectivity, and may be beneficial for investment, trade and tourism with consequential increases in employment. However, this may be offset by the pressure of demand on constrained capacity, which is likely to influence higher fares over time, which is particularly likely to impact on inbound tourism. However, the reduction in capacity declaration for Heathrow and capped capacity at Gatwick, will constrain growth in employment at both airports and for airlines based at both airports.

Housing and demolitions

No housing demolitions will be required.

The introduction of mixed mode for resilience will result in the redistribution of noise impacts.

Number of Houses**New****Demolished**

Nil

Nil

Vulnerable groups

No significant impacts on vulnerable groups are anticipated from deployment of this package, as noise impacts are anticipated to reduce over time, although the mixed mode re-distribution of noise may result in specific local impacts.

Quality of life

There will be a steady decrease in noise levels, reflecting the fleet mix. Some redistribution of noise will be inevitable. Initially, before the introduction of mixed mode at Heathrow, impacts on quality of life will be the same as for the core package. At Heathrow, application of mixed mode will remove respite. Allowing the smoothing of the early morning schedule will result in more early morning arrivals before 06:00 and, compared to the core package, there will be no guaranteed respite after mixed mode is introduced in 2019.

Social impacts

No additional social impacts compared to those indicated under the above sections are anticipated.

COST

Capital

Some modest capital costs are needed at Heathrow to support full mixed mode operations for resilience. The 2007 Impact Assessment carried out to assess the impacts of three different options for increasing Heathrow's capacity estimated that the cost of implementing mixed mode within the 480,000 planning cap would be circa £600 million in 2006 values, adjusted for inflation bias. The Q5 capital investment package (2008- 2013, now Q5+1 to 2014) has delivered £4.79B capital expenditure to date, and in the course of the development of Eastern Campus (T2a and T2B, T3 integrated baggage, and related apron and runway projects a large volume of the infrastructure works indicated for mixed mode in the 2006/7 Impact Assessment will have been completed, so additional capital costs are not considered to be significant, although further works on taxiways, aprons and stands will be required.

Operating

Operating costs of full mixed mode for resilience are expected to be negligible.

Mitigation and compensation

Unknown at this stage.

Surface access

To be considered separately.

OPERATIONAL IMPACT

Resilience

At Heathrow, resilience measures⁶ (forming part of the Airport's Airfield Operational Efficiency Programme) are forecast to deliver savings in cancellations of **£201M NPV** from 2014 to 2030. This delivers an additional £7M NPV compared to the core package. The 2008 runway resilience study showed that Heathrow is far more prone to large-scale cancellations than other airports, due to its operating very near to capacity. Resilience measures will likely have much more impact at Heathrow than at other airports. In addition to the measures identified within the core package, this package also delivers benefits from:

- qualitatively, the more robust operations enabled by the capacity headroom generated by mixed mode will also contribute to an increase in resilience
- design of the schedule for resilience will also have a positive impact and will be enabled by the additional capacity headroom created by mixed mode.

Efficiency

At Heathrow, mixed mode coupled to the other measures are likely to deliver savings⁷ in delays to airlines of **£1715M NPV** due to reduced delays from 2014 to 2030 and savings in delays to passengers of **£802M NPV** from 2014 to 2030 compared to the *status quo* based on 2008 operations and performance, extrapolated to 2030 taking into account forecast fleet changes. In addition to the measures identified within the core package, this package also delivers benefits from:

- mixed mode⁸: £74M savings/year (airlines) and £43M savings/year (passengers) in reduced delays from 2019
- mixed mode⁷: £53M savings/year (airlines) and £26M savings/year (passengers) associated with the avoidance of arrival delays driven by the increase in A380s in the fleet mix. This benefit is realised from 2019 but is delivered prior to that by operational freedoms at the rate of £44M savings/year (airlines) and £19M savings/year (passengers) between 2014 and 2019.

Reliability

Reliability is improved compared to the core package. The introduction of full resilience mixed mode use at Heathrow is likely to result in further reductions in schedule block times⁹, as airlines gain confidence in the significantly improved consistency of departure and arrival times at Heathrow. Based on reduced delay and enhanced resilience at Heathrow and associated airspace, operation to an optimised daily service plan and incentivisation of arrival punctuality, airlines will be able to reduce the buffers in Heathrow schedules, currently necessary to ensure reasonable punctuality against uncertain levels of delay. It is estimate that these savings in block-time buffers could amount to a reduced cost to airlines of at least **£78M NPV** from 2014 to 2030.

Similar levels of buffer are not likely to be applied at other airports so this benefit is likely to be restricted to Heathrow.

Passenger Experience

Probable improvements, compared to the core package, will be due to increased flight reliability and reduced delays. In addition to the measures identified within the core package, this package also delivers benefits for the passenger experience through significantly reduced airborne and ground holding at Heathrow due to mixed mode and local A-CDM

The overall effect will be for Heathrow to progressively become one of the most reliable hub airports in Europe, resulting in lower overall trip times and passengers reducing existing self-defined buffers in their travel schedules, freeing up time for business and leisure purposes.

Safety

Similar to the core package, dependent on airspace redesign (see below). There is likely to be a small reduction in risk delivered through the significantly additional capacity available for resilience.

Other measures will need to be the subject of safety cases.

Scalability

The package is not easily scalable.

Airspace

There is likely to be a need for significant airspace redesign to enable mixed mode fully.

⁶ Derived from fuel savings information provided by Heathrow Airport.

⁷ Delays are derived from modelling and are then monetised using values derived from: Standard inputs for Eurocontrol cost benefit analyses, edition 5.0, December 2011.

⁸ LeighFisher analysis has estimated arrival delay using the mixed mode models developed in the CAA runway resilience study (http://www.caa.co.uk/docs/589/ICF_runway_resilience_final_report_16Feb09.pdf)

⁹ Based on the observations on the extension of short-haul block-times reported in the CAA runway resilience study (http://www.caa.co.uk/docs/589/ICF_runway_resilience_final_report_16Feb09.pdf)

DELIVERY**Timescale**

The measures would be delivered in phases starting in 2014 with the core package. Mixed mode would be delivered by 2019.

Technical and operational risks

The principal technical and operational risks are safety cases for mixed mode at Heathrow.

Planning risk

There is planning risk associated with:

- permission for mixed mode operations
- permission to apply operational freedoms, prior to the introduction of mixed mode
- significant airspace redesign needed to enable mixed mode operations.
- permission to cap Gatwick at 90%
- airlines willing to relinquish slots at Heathrow to allow actual (rather than nominal) reduction in capacity declaration.

MEASURES INCLUDED IN THE PACKAGE INCREMENTAL TO THE CORE PACKAGE

Measure	Description	Template ref.
Resilience mixed mode	Introduction of mixed mode operations for Heathrow runways. This would allow both runways to be used for both arrivals and departures as opposed to current operations where a single runway is currently used for arrivals and the other for departures. This measure has been proposed to increase resilience within the current Heathrow planning cap (480,000 ATMs).	ApOP-HMM-2
Reduced capacity declaration at major airports	This measure would provide a lower capacity declaration at airports, to manage down congestion over time (or prevent airports reaching full capacity) so as to minimise the impacts of congestion on resilience. The proposal would be for a greater focus to be provided on the efficient utilisation of slots through the slot allocation process.	SSR-DMA-1
Ban business and general aviation from Heathrow and Gatwick	This would prevent general and business aviation flights from using Heathrow (and potentially Gatwick), with the intention of improving capacity usage at those airports.	REG-ACR-1
Maintain night flight regime	This supports the retention of the current night flight regime.	NFit-MRE-1 NFit-MRE-2

ASSUMPTIONS (TO BE DELETED FROM FINAL VERSION OF TEMPLATE)

Core package

Measure	Approach and assumptions
En route arrival management	<p>Starts 2019. Assumes linear holding can absorb 2 to 3 minutes of stack holding. Modified stack holding is calculated from operational data by subtracting the linear hold from each flight's stack hold and averaging over summer and winter seasons to give an average reduction in stackholding. Assumes that there is no time saving because the queue is shifted upstream. Assumes that there is a saving in CO₂ emissions driven by the reduction in average stack holding time with the multiplier derived from the analysis underpinning the Helios airborne holding report (reference: Feasibility and options for reducing airborne holding for Heathrow arrival, Helios, 30 June 2012 produced under contract 1387 (Helios) service order number 20, commissioned jointly by CAA and NATS). Gives a lower bound of the CO₂ saving because it omits the saving from the en route phase of flight arising because of a slower cruise speed, even though the flight is 2 to 3 minutes longer. Calculation is limited to Heathrow flights even though benefits likely to accrue at other airports during busy arrival periods. Assumed that this benefit is additive to mixed mode because it will be used to address residual stack holding in the mixed mode scenario.</p> <p>Simple scaling is possible for Gatwick based on the 2008 runway resilience report that shows airborne holding delays at LGW are 16% of those at LHR in summer and 7% in winter. Averaged this gives a yearly average of 14% - assumes that en route arrival management delivers 14% of the benefits at Gatwick that it delivers at Heathrow. Calculation limited to Heathrow and Gatwick even though benefits likely to accrue at other airports during busy arrival periods.</p>
Time based separations	It is assumed that time based separation is of limited basis in the mixed mode environment because the effects of wind will be ameliorated by the additional spacing available from the use of two runways simultaneously for arrivals, interspersed with departures.
Single runway for early morning arrivals	Starts 2015. Assumes that the demand profile from 05:00 to 07:59 is smoothed over those three hours. With the statistical models as currently established the modelling resolution is one hour – so it is not possible to look at the schedule in more detail. Single runway arrivals are assumed for 05:00 to 07:00. Assumes that this measure is not affected by the measure to maintain the current night flight regime included in the package.
Independent parallel approaches at Heathrow	Enables optimum mixed mode arrivals. A necessary precursor for mixed mode but does not deliver any benefits in its own right.
Reduction in separation between SIDs	<p>Starts 2016 and runs to 2019 when it is subsumed into mixed mode. Assumed to be a necessary precursor to mixed mode. Its benefits are subsumed into those of mixed mode, which is set at 15% capacity increase for departures, corresponding to the maximum benefit available from the reduction in the separation between SIDs.</p> <p>The 2008 runway resilience report shows a very similar average ground holding delay at Gatwick compared to Heathrow. The total delays therefore scale according to traffic (assumed to be 2:1): assume departure benefits at Gatwick are 50% of those at Heathrow.</p>
Local A-CDM	<p>Starts 2014. Assumes A-CDM and other process improvements deliver (source: Information provided by Heathrow Airport) the following at LHR:</p> <ul style="list-style-type: none"> - reduction in departure holding of 1.5 minutes per flight (assumed also to apply at Gatwick and scales from Heathrow results on a 2:1 basis, as explained above) - avoidance of 200 cancellations per year. <p>Assumed to be additive to mixed mode benefits.</p>
Operational freedoms	<p>Starts 2014 and runs to 2019 when it is overtaken by mixed mode. Assume that the availability of operational freedoms is used to overcome the negative capacity impact of increasing numbers of A380s (21 arrivals in 2014 (3%), 30 arrivals per day in 2016 (4.5%), 62 arrivals in 2030 (5.5%)) (Source: NATS). The Helios airborne holding report (reference: Feasibility and options for reducing airborne holding for Heathrow arrival, Helios, 30 June 2012 produced under contract 1387 (Helios) service order number 20, commissioned jointly by CAA and NATS) is used to compare the difference in delay using a 20 minute trigger for TEAM with the assumption that all A380s are landed on the departure runway (i.e. no negative impact on capacity). This difference is assumed to be the sole quantifiable benefit of operational freedoms based on the results of the recent trial.</p> <p>The negative impact on departures is calculated by adding the A380 arrivals to the departure runway loading taking account of the additional capacity gained through reduction in separation of SIDs</p>

Scenario: 2	Maximum resilience		
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LVP	Information provided by Heathrow Airport suggests that improved LVP procedures will result in 600 fewer cancellations per year split at a ratio of 70:730 long haul:short haul. Assumed to be additive in the mixed mode environment
Block time reduction	The 2008 runway resilience study shows an increase in block time of short haul flights to LHR of up to 18 minutes over 20 years. It is assumed that increases in reliability/resilience will reverse this increase by 50% over a period of 10 years, starting in 2019. Eurocontrol standard figures for strategic delays are used to calculate the associated benefit of this. Assumed to be additive in the mixed mode environment.

Maximum resilience increments

Measure	Approach and assumptions
Mixed mode	<p>Starts 2019. Assumes that mixed mode operations start in 2019 (five year lead time) and that they generate a 10% increase in capacity for arrivals, balancing the likely benefits generated, the amount of airspace change needed and the impact on other operations and airports. For departures, the capacity increase is assumed to be 15% - delivering the maximum generated by the reduced SID separation augmented by the freedom to use both runways simultaneously for departures. Mixed mode will also overcome the delays in the current operational scenario that would occur due to the increased proportion of A380s in the fleet mix without the penalty for departures assumed for operational freedoms.</p> <p>The overall benefits are calculated by taking the core package benefits for the years prior to the application of mixed mode and the mixed mode benefits thereafter. Benefits are calculated based on existing flights/passengers obtaining the full delay benefits and additional flights/passengers obtaining half those benefits.</p>
Lower capacity declaration at Heathrow	Starts 2014. Assumes that the capacity declaration is reduced to provide a cap at 90% of capacity (similar to the Gatwick cap in this package). However, because of grandfather rights it is unlikely that slots will be handed back so the underlying (constrained) demand level will remain the same. The impact of the lower capacity declaration will be to remove the capacity to award ad hoc slots to back-fill the schedule when flights are cancelled – it is assumed that this will prevent general and business aviation from operating at the airport and reduce on the day demand by approximately 8 arrivals and departures per day (1%).
Cap movements at major airports at 90% of capacity	This will ensure that major airports do not over schedule and mean that delays do not escalate to unmanageable levels and preserve resilience.
Ban general and business aviation from Heathrow and Gatwick	Starts 2014. This is covered by the reduced capacity declaration, above, at Heathrow. At Gatwick it will likely mean that the actual demand will be approximately 89% of capacity instead of at the 90% cap as it will not be possible to backfill cancellations with ad hoc slots for general and business aviation.
General	All four components of the package increment have to be considered together as they are not separable nor additive.

Quantitative assessment for resilience and efficiency

Item	Costs	Annual benefits/savings		
		Low	Med.	High
En-route arrival management, from 2019 onwards	£6M (ref: NATS)	70ktonnes CO2 saving. Fuel cost saving: £15M	105ktonnes CO2 saving Fuel cost saving: £22M	135ktonnes CO2 Fuel cost saving: £29M
Time based separations: not applicable in this package as it starts in 2019 but will be overtaken by mixed mode	N/A	N/A	N/A	N/A
Early morning arrivals on single runway from 2016 to 2019	Small	55ktonnes CO2 saving Total aircraft operating cost saving:£8.5M Pax opportunity cost saving: £4.1M		83ktonnes CO2 saving Total aircraft operating cost saving:£13.6M Pax opportunity cost saving: £6.6M
Independent parallel approaches at LHR	TBD		51ktonnes CO2 saving Total aircraft operating cost saving:£9.0M Pax opportunity cost saving: £4.3M	
Reduction in separation between SIDs from 2106 to 2019	£500k (source: NATS)	34ktonnes CO2 saving 138 tonnes NOx savings Total aircraft operating cost saving:£14.7M Pax opportunity cost saving: £10.0M		47ktonnes CO2 saving 191 tonnes NOx savings Total aircraft operating cost saving:£20.1M Pax opportunity cost saving: £13.8M
Local A-CDM from 2014	Sunk		26ktonnes CO2 saving 106 tonnes NOx savings Total aircraft operating cost saving:£10.9M Pax opportunity cost saving: £7.4M. Avoided cancellations: £6.3M	
Operational freedoms to reduce impact of A380s (2014 to 2016)	Small cost and 15 additional de-alternated flights per day		68ktonnes CO2 saving Total aircraft operating cost saving:£44M Pax opportunity cost saving: £19M.	
Operational freedoms to reduce impact of A380s (2016 to 2019)	Small cost and 20 additional		93ktonnes CO2 saving Total aircraft operating cost	

	de-alternated flights per day		saving:£49M Pax opportunity cost saving: £21M.	
Improved LVP processes: triggers for application; and increased flow rates with MLS, from 2014			Avoided cancellations: £11M	

Quantitative assessment for resilience – maximum resilience increment

Item	Costs	Annual benefits/savings		
		Low	Med.	High
Apply mixed mode at Heathrow with no additional flights starting in 2019	Small		263ktonnes CO2 saving and 1060 tonnes NOx saving Airline delay cost saving of: £74M from general delay reduction and £53M from avoiding A380 associated delays Passenger cost saving: £43M from general delay reduction and £26M from avoiding A380 associated delays	