Scenario: 5	Extra LHR capacity with offsets		

ASSESSMENT SUMMARY

		Impact relative to current situation				
Criterion	**Constituency**	**++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	The analysis undertaken to date on this scenario has determined that it is likely undeliverable or that, if delivered, it would produce negligible benefits at a significant cost. The elements required to unlock any additional capacity (in terms of Heathrow operations) have fundamental incompatibilities with many of the proposed noise mitigation measures.
Strategic fit	Increasing the cap of flights at Heathrow to 500,000 ATM would benefit airlines and airline customers at Heathrow by enabling a wider range of routes and frequencies to be operated, including the entry of additional airlines to increase competition (with three additional slot pairs per hour). The introduction of enhanced TEAM and TED would also deliver improvements in resilience and reliability. The overall effect would have a positive effect on connectivity for the UK. However, this would also contribute to higher noise levels purely because of the increase in flights, although this would be partially offset by other measures. There would also be some implementation issues around increasing the Heathrow planning cap, without the introduction of full mixed mode to adequately accommodate the additional flights and deliver enhanced resilience.
Economy	Net NPV of **£3.8B** (2014-2030) compared with the status quo[1], an increase in NPV of around £1.2B compared with the core package, partly due to the benefits of increased capacity being utilised by airlines to provide more commercial services and savings to existing passengers from more direct services, increased frequencies and more competition. This will likely increase connectivity with international destinations and UK connectivity by increasing domestic services to feed into Heathrow's international operations. This will contribute towards incremental increases in trade, tourism and investment.
Surface Transport	Increased demand on surface transport at Heathrow due to increased passengers, although this may largely be accommodated by the introduction of Crossrail and upgrades to the Piccadilly line.
Environment	There is a reduced environmental benefit from this scenario compared to the core package. Air quality emissions are not reduced compared to the status quo, and carbon emissions deliver only 1.93Mt savings from 2014 to 2030, showing an NPV of £31.8M costed on a central scenario of traded carbon prices (compared to 7.12Mt CO_2 and £147.9 NPV for the core). This scenario will result in greater noise impacts than the core package. Additional noise associated with 20,000 additional movements at Heathrow each year will be generated. Overall this may be considered to have a neutral impact. Whilst on a technical level the proposed increase in movements will not result in a significant increase in noise, particularly with the expected fleet modernisation, the public reaction is expected to be negative due to the growth in ATMs. This is countered by displacement of thresholds and measures to incentivise quieter aircraft which could be linked to the proposed daytime quota count system. A comparable system has been shown to be effective for night noise control (ECRD 0204), although the cost benefits have not been calculated to date. Overall the noise impacts and enhanced mitigation measures may be considered to have a neutral impact, but the additional noise energy results in a negative impact
People	No significant impacts beyond those identified for the core package are anticipated, although employment prospects are considered to be bolstered by aviation industry growth. Additional noise in the earlier part of the assessment period will have specific local impacts.
Cost	Negligible cost impacts beyond the core package, although some additional infrastructure works may be necessary. Any package that increases ATM caps at the major airports, or requires extension to the night flights regime, will incur additional planning costs, and this should be considered in addition to capital expenditure on infrastructure.
Operational Viability	There are significant concerns about the effective deliverability of such an increase in capacity in parallel with the effective use of operational freedoms to manage resilience, and the addition of 20,000 ATM without full mixed mode operations may prove unfeasible.
Delivery	To increase the Heathrow capacity cap would require a controversial planning inquiry.

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

ECONOMIC IMPACTS

Impact on Industry (summary commentary) Overall, compared to "the status quo" this package will reduce costs for airlines and passengers, and increase utility for airlines and passengers by delivering net economic benefits of around **£3.8B** (NPV) by 2030 for the aviation sector and its users, including the value of the remaining core package. This is around **£1.2B** (NPV) ***higher*** than the core package. The primary impact of the "extra capacity at Heathrow with offsets" scenario on the aviation industry will be at Heathrow. This would see additional flights at Heathrow, increasing airline services, including frequencies, routes and airline operators at the airport. In addition, after the capacity cap is relaxed, compared to the core package, airlines and passengers will experience penalties in time and operating costs, because the higher capacity declaration negates the benefits of enhanced TEAM and TED and other operational freedoms in improving resilience and increases the disruption risk.	
Airports	Compared to the core package, Heathrow Airport will have more flights (up to 20,000) and passengers (up to 3mppa increase), although delays and flight reliability will be lower, as the proposed offsets provide fewer improvements to reliability than the core package. It is likely that this capacity increase will have a very small incremental impact on Gatwick Airport in the short term, as a few services are shifted to Heathrow, but over the longer term the capacity constraints at both airports will see Gatwick's capacity quickly reutilised for other services.
Airlines	Airlines will have access to additional slots. Compared to the core package, the "extra capacity at Heathrow with offsets" scenario will deliver ***higher*** quantifiable airline benefits (2014 to 2030) by around **£1.1B NPV** primarily due to the ability to introduce new services (on average three more flights per hour) (a total of **£2.6B NPV** in benefits). These will be primarily constrained by the inability to introduce any new services between 2300 and 0620.
Passengers	Compared to the core package, the "extra capacity at Heathrow with offsets" scenario will deliver ***higher*** passenger benefits (2014 to 2030) of **£398M NPV (**a total of **£982M NPV in benefits)** primarily due to the time and fare saving benefits of new services (both new routes and increased frequency of services) at Heathrow, including the benefits for generated traffic (users that would not otherwise have travelled).
DfT WebTAG Impacts (summary commentary) • Economic Surplus Producers: Compared to the core package, at least **£1.1B NPV *more*** in surplus due to increased provision of profitable flights. • Economic Surplus Passengers: **£398M NPV *more*** benefits to passengers due to reduced travel times and fares. • Time Savings From Delay Reduction: Likely to be marginally reduced compared to the core package due to the increased number of flights which is likely to erode delay reduction benefits. • Public Accounts: Likely to be positive, as increased capacity services should result in higher APD revenue. • Wider Impacts And Regeneration: (See National Economic Impacts, Local & Regional Economic Impacts); • Surface Access Impacts: Nil	
User benefits	Increased choice of direct flights, routes, frequencies and airlines because of new capacity.
Externalities (e.g. noise & CO_2)	This scenario delivers considerably reduced savings compared to the core package. Based on CO_2 savings, and the price of in the central scenario of traded carbon cost[2] savings are indicated over the period 2014 to 2030 of approximately **£31.8M NPV**. Noise cost benefits have not been quantified. Respite will be lost due to increased de-alternation on arrivals and, possibly, departures at Heathrow.
Connectivity to domestic markets (summary commentary) Allowing an additional three flights an hour overall should result in a proportion of those flights being used to increase frequencies to existing domestic airports or introduction of services to such airports, increasing connectivity between Heathrow and domestic markets.	
International connectivity (interline vs. point-to-point; market access)	An increase in flights at Heathrow, should result in additional flights to existing destinations and introduction of some new destinations, enhancing connectivity.
Domestic connectivity (surface transport & domestic aviation)	Impacts are expected to be negligible.
National Economic Impacts (summary) Compared to the core package, the "extra capacity at Heathrow with offsets" scenario will result in marginally lower	

[2] https://www.gov.uk/carbon-valuation

benefits in terms of reduced delays and operating costs for passengers and airlines, but significantly additional benefits by being able to offer new services, enhancing connectivity and relieving pressure on airfares. This is likely to have a modest positive overall economic impact by allowing some demand to be met by increased airport capacity.

Local & Regional Economic Impacts (summary)

- Support to trade: Allowing more flights at Heathrow supports increased trade, investment and inbound tourism, with additional connectivity meaning that new direct routes, increased frequencies and new market entry should reduce fares and air cargo costs, and travel times for business and leisure travellers. This should positively contribute towards increased trade, tourism and investment.
- Creation of new industries: Negligible, but positive impact on new industries due to a marginal increase in connectivity.
- Land Impact: Negligible impact
- Direct Employment: Positive impact on employment at Heathrow and with airlines operating at Heathrow due to the increase in flights and passengers.
- Indirect Employment: Positive impact on employment in tourism, trade and related service industries due to the increase in flights and passengers.
- Induced Employment: Negligible but likely positive impact
- Catalytic Employment: Negligible but likely positive impact
- Agglomeration Impacts: Negligible but likely positive impact.
- Residual Value: Not relevant

ENVIRONMENT

Noise

This scenario will result in greater noise impacts than the core package. Additional noise associated with 20,000 additional movements at Heathrow each year will be generated. Overall this may be considered to have a neutral impact. Whilst on a technical level the proposed increase in movements will not result in a significant increase in noise, particularly with the expected fleet modernisation, the public reaction is expected to be negative due to the growth in ATMs. This is countered by displacement of thresholds and measures to incentivise quieter aircraft which could be linked to the proposed daytime quota count system. A comparable system has been shown to be effective for night noise control (ECRD 0204[3]), although the cost benefits have not been calculated to date. Overall the noise impacts and enhanced mitigation measures may be considered to have a neutral impact, but the additional noise energy results in a negative impact.

The business as usual operation of TEAM that will be needed once the capacity cap is relaxed will result in significantly higher levels of de-alternation than at present of up to between 50 and 100 arrivals per day depending on the specific implementation. Irrespective of how the package is applied, it is likely that there will be little or no respite from runway alternation from 13:00 hours onwards and, in the worst case, no respite at all.

Local air quality

This scenario offers significantly reduced local air quality benefits compared to the core package (6,850 tonnes reduction). Quantitative analysis indicates this package actually delivers a small increase of **40 tonnes** of NO_x at Heathrow over the period 2014 to 2030[4], compared to the status quo situation based on 2008 operations and performance, extrapolated to 2030 taking into account fleet changes. This is because of increased ATM and reduced ability to deliver delay savings.

- TEAM and TED coupled to an increase of 20,000 movements per year: resulting in an increase of 181 tonnes per year from 2019 onwards resulting from increased departure delays due to a combination of increased demand and the application of TEAM reducing departure runway capacity.
- No savings have been ascribed to reduced engine taxi[5], despite the potential NOx and noise benefits, as the increase in ATMs will restrict the opportunity for ground movement flexibility due to constrained taxiway availability.

Climate change

This scenario offers significantly reduced carbon savings compared to the core package (7.12Mt). Quantitative analysis indicates that this scenario delivers savings of approximately **1.93M** tonnes of CO_2 over the period 2014 to 2030[6] compared to the status quo based on 2008 operations and performance, extrapolated to 2030 taking into account forecast fleet changes. This reduction in available savings compared to the core package is linked to TEAM and TED[7] at Heathrow coupled to an increase of 20,000 movements per year resulting in increased delays creating approximately 203,000 additional tonnes per year.

There are likely to be further impacts on climate change from reduced engine taxi procedures across main airports excluding Heathrow that could save 23,250 tonnes of CO_2 per year from 2016.

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3 Review of the Quota Count (QC) System: Re-analysis of the Differences between Arrivals and Departures, http://www.caa.co.uk/application.aspx?catid=33&pagetype=65&appid=11&mode=detail&id=717

4 LeighFisher analysis has estimated delay and NOx benefits from a relationship to CO_2, 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 Reduced engine taxi benefits for NOx and CO_2 have been calculated from reference to BMI trial results at Heathrow (http://www.heathrowairport.com/about-us/community-and-environment/sustainability/case-studies/taxiing-the-way-to-lower-emissions), the estimate of ground level Aircraft NOx at Heathrow (http://www.heathrowairport.com/static/Heathrow/Downloads/PDF/air-quality-strategy_LHR.pdf) and apportioned to 25,000 ATMs based on CAA activity data for 2008. Sustainable Aviation CO_2 roadmap identified that taxiway availability would constrain any benefits from RET, so the approach here is conservative

7 LeighFisher analysis has estimated arrival and departure delays and associated emissions arising from TEAM and TED scenarios using the delay models developed in the CAA runway resilience study (http://www.caa.co.uk/docs/589/ICF_runway_resilience_final_report_16Feb09.pdf) and

PEOPLE

Employment

Broadly similar impacts to the core package, with some additional benefits. Whilst no significant impacts on employment are anticipated from deployment of the extra LHR Capacity package, it is likely to create a positive impact for employment overall, as the ability to meet some demand, currently constrained, is likely to boost employment at Heathrow, airlines that are able to increase services and the businesses that support them. This may also have indirect positive effects on employment, due to increased tourism.

Housing and demolitions

No housing demolitions will be required. The overall impact of 500,000 ATMs under segregated mode operation could see an initial increase in the number of people within the 57db Leq contour dependent upon the rapidity of fleet modernisation.

Number of Houses	
New	*Demolished*
Nil	Nil

Vulnerable groups

Some impacts on vulnerable groups might be anticipated from deployment of the maximum capacity package, as although noise impacts are anticipated to reduce over time, the widening of the noise footprint unless mitigated by fleet improvements may result in specific local impacts. Even so, an increase in ATMs even with noise event sound level reductions is likely to be perceived negatively in noise terms, if historic precedent is accepted.

Quality of life

Initially, before the introduction of enhanced TEAM and TED at Heathrow, impacts on quality of life will be the same as for the core package. In addition, extra noise will be generated by the increased number of movements, assumed to be from 2019 although none of these new movements would take place in the night period. There will be considerably more de-alternation after the cap is increased due to the application of TEAM and TED to counter delays associated with the additional demand.

Social impacts

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

COST

Capital

Small

- negligible

Operating

Small

- negligible

Mitigation and compensation

Unknown at this stage.

Surface access

To be considered separately.

OPERATIONAL IMPACT

Resilience

Resilience measures delivered by the core package **would likely be prejudiced** by the addition of 20,000 additional flights that will reduce the headroom provided by measures in the core package. Coping with the increased number of flight movements would require the application of TEAM and TED as business as usual measured with the result that there would be no additional headroom available during disruption, increasing its impact. In addition, operating the airport at and 100% utilisation would increase the likelihood of disruption occurring as well as accentuating its impact.

Efficiency

At Heathrow, overall this scenario is likely to deliver net savings in delays to airlines of **£774M** due to reduced delays from 2014 to 2030 and net savings in delays to passengers of **£319 NPV** compared to the status quo situation based on 2008 operations and performance, extrapolated to 2030 taking into account forecast fleet changes. However, when the additional 20,000 flights per year additional flights are allowed, even with the application of TEAM[8], there is a delay penalty costing airlines approximately an additional **£38M per year in increased delay costs** and passengers approximately **£15M per year in increased delay costs**.

Reliability

As this scenario does not deliver improved delays nor additional capacity headroom, it is unlikely to deliver significantly improved reliability at Heathrow to enable schedule buffers to be reduced. In fact, the additional stress that is placed on the system due to the additional capacity allowed, is likely to increase the risk of disruption and hence decrease reliability, potentially resulting in even higher schedule buffers.

Passenger Experience

Reduced fares for passengers at Heathrow are likely to be available compared to the core package. Qualitatively the passenger experience will be degraded because of increased airborne and ground holding at Heathrow due to the additional 20000 movements without substantial physical capacity increase.

Safety

Displaced thresholds and more enhanced TEAM and TED may require safety cases.

Scalability

The scenario is not easily scalable and will, in fact, reduce the scope for process enhancements at Heathrow due to the additional stress placed on the system due to maximum utilisation.

Airspace

There is potentially a need for significant airspace redesign to enable enhanced TED.

DELIVERY

Timescale

The measures would be delivered in phases starting in 2014 with the core package. Additional capacity and TEAM and TED would be delivered by 2019.

Technical and operational risks

The principal operational risk associated with this scenario is the impact of additional demand on performance without any substantial increase in physical capacity. Modelling indicates that the additional departures could be accommodated through the enhanced capacity delivered through the core package measures, principally enhanced SIDs, without the need for significant TED but at the penalty of increased delays (from 7.8 minutes per departure in the core package to 9.3 minutes per departure in this package). For arrivals, after the positive impact of the use of the single runway in the early morning has dissipated, TEAM would also need to be applied continuously to allow the runways to cope with the additional demand. This would result in approximately 50 de-alternated flights per day; TEAM would also no longer be available as a safety valve but would be part of business as usual. Modelling indicates that this would also result in a doubling of the average arrival delay per flight (from approximately 4.8 minutes per flight at 2008 levels to approximately 9.8 minutes per flight). After the positive impacts of the use of the single runway for arrivals has dissipated, modelling predicts that the average delays per arrival are likely to reach levels of approximately 16 minutes per flight, even with TEAM applied continuously from 13:00 hours onwards, resulting in approximately 50 de-alternated flights. If single runway early morning smoothing of the schedule were not allowed before 06:00 hours, it would be necessary to apply TEAM for 14 out of the 15 hours from 06:00 to 21:00 hours, resulting in approximately 100 de-alternated arrivals per day. The other principal technical and operational risks are that safety cases for displaced thresholds and enhanced TEAM and TED will be required.

Planning risk

Beyond issues identified in the Core Package, there is planning risk associated with:

[8] LeighFisher analysis has estimated arrival and departure delays from TEAM and TED scenarios using the delay models developed in the CAA runway resilience study (http://www.caa.co.uk/docs/589/ICF_runway_resilience_final_report_16Feb09.pdf) and

Scenario: 5	Extra LHR capacity with offsets		

- permission for an increased capacity cap at Heathrow
- permission to apply operational freedoms regarding additional TEAM and TED.

Scenario: 5	Extra LHR capacity with offsets		

MEASURES INCLUDED IN THE PACKAGE INCREMENTAL TO THE CORE PACKAGE

Measure	Description	Template ref.
Heathrow planning cap raised to 500,000 ATMs.	At present Heathrow has a planning cap which allows it to operate 480,000 Air Traffic Movements (ATMs) per annum. Any move to change this cap would require planning permission.	
Enhanced TEAM and TED	Allocating arrivals to the departure runway as needed to improve overall efficiency (TEAM). For arrivals when delay is occurring or anticipated, the designated departure runway can be used for arrivals to increase the overall arrival rate (TEAM). Allocating departures to the arrivals runway to improve overall efficiency as circumstance allow (TED). In addition, when conditions allow and departure delays are anticipated / occurring, the designated arrivals runway will be used for departures (TED).	ApOP-HOF-1 ApOP-HOF -3
No increase in the night flights cap	Whilst some submissions indicate a position opposed to night flights in principle, the current regime is supported with a clear indication that no increase in night flight movements should be allowed Other submissions were concerned that there should be no decrease in night flight allocation, either immediately or in the next regime (from 2014)	NFlt-MRE-1 NFlt-MRE-2
Displaced thresholds	The 'threshold' is the physical point on a runway where an aircraft aims to touch down. Operating a displaced threshold results in that point being further along the runway. Operating a displaced threshold would result in aircraft being higher above the ground at a specific distance from touchdown, with a resultant reduction in noise contours.	ApOP-GOI-4
Incentivise quieter aircraft	This proposal would see the introduction of a variable landing charge regime which charged night aircraft movements higher landing charges than those operating during the daytime.	REG-ACR-2
Incorporate QC system into full day operations	This measure proposes an expansion in the current use of QC categories as a method for incorporating noise management into airport capacity management. The QC system allows each night flight to be individually counted against an overall noise quota (or noise budget) for an airport according to the QC rating (i.e. the noisiness) of the aircraft used. This measure would extend this QC system to day time operations.	EMit-NMT-1
Introduce noise regulator	Support for the creation of an independent body responsible for the regulation of aircraft (and potentially other sources of) noise, to introduce transparency and consistency into the system.	Emit-NMT-3

Scenario: 5	Extra LHR capacity with offsets		

ASSUMPTIONS

Core package

Measure	Approach and assumptions
En route arrival management	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 CO_2 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 CO_2 saving because it omits the saving from the en route phase of flight arising because of s 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. 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.
Time based separations	Starts 2019. Assumes that TBS delivers increased arrival flows during high (20 knots at 3000ft) headwind conditions (reference operational freedoms trigger condition). Assumes that this condition is met 20% of the time in summer and 36% of the time in winter. TBS adds 2 to 4 arrivals per hour during very high headwind conditions (source: NATS). Half this increase is assumed as a baseline. Benefits calculated in terms of reduced stackholding using the models developed for the CAA runway resilience study that includes the impact of strong winds for the day from 08:00 onwards (assumes that pre-08:00 is dealt with through TEAM which is applied virtually every day from 06:00 to 08:-00. This impact is neutralised by adding back TBS capacity scaled in proportion to the likely occurrence of strong winds (2 to 4x0.20 for summer and 2-4x0.35 in winter).
Single runway for early morning arrivals	Starts 2015 and runs to 2019 when it is subsumed into the removal of the night flight cap. The analysis 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.
Independent parallel approaches at Heathrow	Enables optimum TEAM arrivals. A necessary precursor for enhanced TEAM but does not deliver any benefits in its own right.
Reduction in separation between SIDs	Starts 2016 and runs to 2019 when it is subsumed into enhanced TED. Assumed to be a necessary precursor to enhanced TED. Its benefits are subsumed into those of enhanced TED, which is set at 15% capacity increase for departures, corresponding to the maximum benefit available from the reduction in the separation between SIDs. 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) resulting in departure benefits at Gatwick that are 50% of those at Heathrow.
Local A-CDM	Starts 2014. Assumes A-CDM and other process improvements deliver (source: Information provided by Heathrow Airport) the following at LHR: - 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. Assumed to be additive to TEAM and TED benefits.
Operational freedoms	Starts 2014. 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. 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
LVP	Information provided by Heathrow Airport suggests that improved LVP procedures will result in 600 fewer cancellations per year split at a ratio of 70:30 long haul:short haul. Assumed to be additive in the TEAM and TED 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. This package of measures results in comparable delay performance to the current situation so it is assumed that it will not deliver block time savings.

Extra capacity with offsets increments

Measure	Approach and assumptions
Raise the ATM cap	Assumes that the Heathrow planning cap is raise to 500000 ATMS per year.
Enhanced TEAM and TED	Starts 2019. Assumes that TEAM and TED are applied when a 20 minute delay trigger is reached. Assumes that TEAM, coupled with independent parallel approaches, delivers up to 5% additional capacity when it is applied but that there is an equivalent capacity penalty on departures. Assumes that TED, coupled with enhanced SIDs delivers 15% additional departure capacity when it is applied. It is assumed that TEAM and TED can be applied simultaneously.
No increase in night flights cap	Starts 2019. From a resilience perspective, it is assumed that this measure does not impact on the use of a single runway for early morning arrivals, which is included in this package.

Scenario: 5	Extra LHR capacity with offsets		

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 from 2019 onwards	£13M (ref: NATS)	41ktonnes CO2 saving Total aircraft operating cost saving:£8.6M Pax opportunity cost saving: £4.1M	58ktonnes CO2 saving Total aircraft operating cost saving:£12.1M Pax opportunity cost saving: £4.9M	72ktonnes CO2 saving Total aircraft operating cost saving:£14.9M Pax opportunity cost saving: £7.2M
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	Small cost and		93ktonnes CO2 saving	

A380s (2016 to 2019)	20 additional de-alternated flights per day		Total aircraft operating cost 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 capacity increment

Item	**Costs**	**Annual benefits/savings**		
		Low	Med.	High
Revise the planning cap at Heathrow to 500000 ATMs per year, whilst applying TEAM and TED with a 20 minute trigger	Small – 15 additional de-alternated flights per day.		20000 additional slots at Heathrow 204ktonnes CO_2 penalty and 180 tonnes NOx penalty compared to the current situation caused by increased delays with 500000 movements without substantial capacity increased Airline delay cost penalty of: £44M from increased delays Passenger cost penalty of: £17M from increased delays	