Strategy and Policy Department

Operating Resilience of the UK's aviation infrastructure and the consumer interest

CAP 1515

Contents

Executive summary

Introduction

1.   The UK's airport and airspace capacity is constrained, and there will be no new significant airport runway capacity until 2025. Our busiest airports are regularly among the worst performing in Europe in terms of on-time performance. Increases in capacity, such as those which arise from higher utilisation of airports, bring more choice and competition, but passengers may also suffer if that leads to more delays and worse reliability.

2.   Existing airport and airspace infrastructure will be under increasing demands in the future. In 2016, NATS were predicting[1] a further 9% increase in aircraft movements at the five major London airports by 2022.

3.   This report examines the current balance of delay and punctuality[2] against the number of flights at the airports in the South East of the UK where congestion in airspace and at airports is greatest, particularly in the planning and operational processes that the industry undertakes, and comments on how it reflects the consumer interest.

Delay

4.   Passengers can be affected by different types of delay even if their flight is considered to be on-time. For example, passenger waiting and queue times may exceed expectations (irrespective of ultimate time of arrival) at security, the gate, on the aircraft waiting to take-off, holding in the air, baggage reclaim or at immigration. However, in this study we generally take delay to refer to

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[1] http://nats.aero/blog/2016/02/record-demand-will-put-pressure-on-airspace-capacity10605/

[2] 'Delay' generally refers to the average number of minutes after its scheduled time that a flight arrives or departs, whereas 'punctuality' generally refers to the proportion of flights that are within a certain delay threshold, usually early to 15 minutes late. Such flights are generally referred to as 'on time' and so 'on-time performance' has the same meaning as punctuality.

on/off stand delay (i.e. the delay compared to the purchased ticket times) of which other delays may be a contributing factor.

5. A lack of capacity (both infrastructure and resources), variability and prolonged high utilisation can lead to increasing delays, reduced on-time performance (which is the proportion of flights considered to be no more than 15 minutes later than their scheduled on/off stand time) and difficulties in recovery.

6. At the UK's busiest airports, on-time performance has generally been decreasing and delays have been increasing in recent years, as shown in Figure 1. Although UK airports are not the worst performing in the world[3], there is room for improvement.

Figure 1: On-time Performance, 2012 – 2016
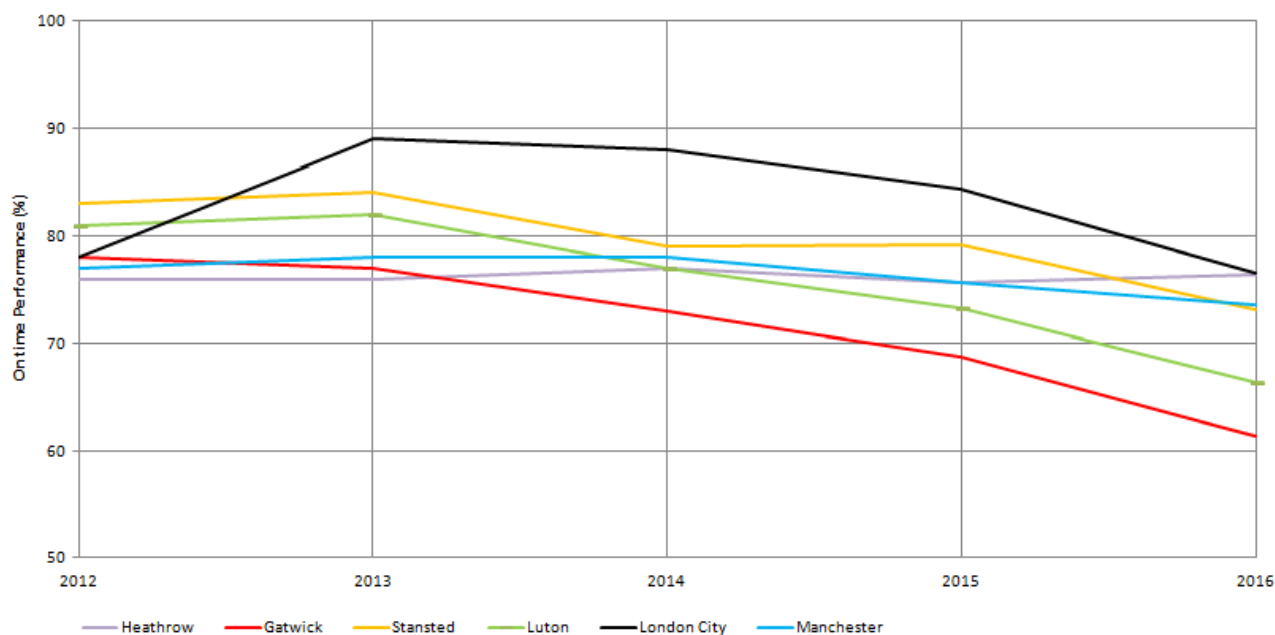
Source: CAA Statistics

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[3] The effects of airport and airspace capacity constraints are evident in other countries such as US and China.

7.   As Figure 2 shows, the decline in on-time performance has happened alongside an increase in runway utilisation for UK airports, some of which are constrained by the capacity of their runways[4].

Figure 2: Annual Runway Capacity Utilisation – 2012-2016[5]
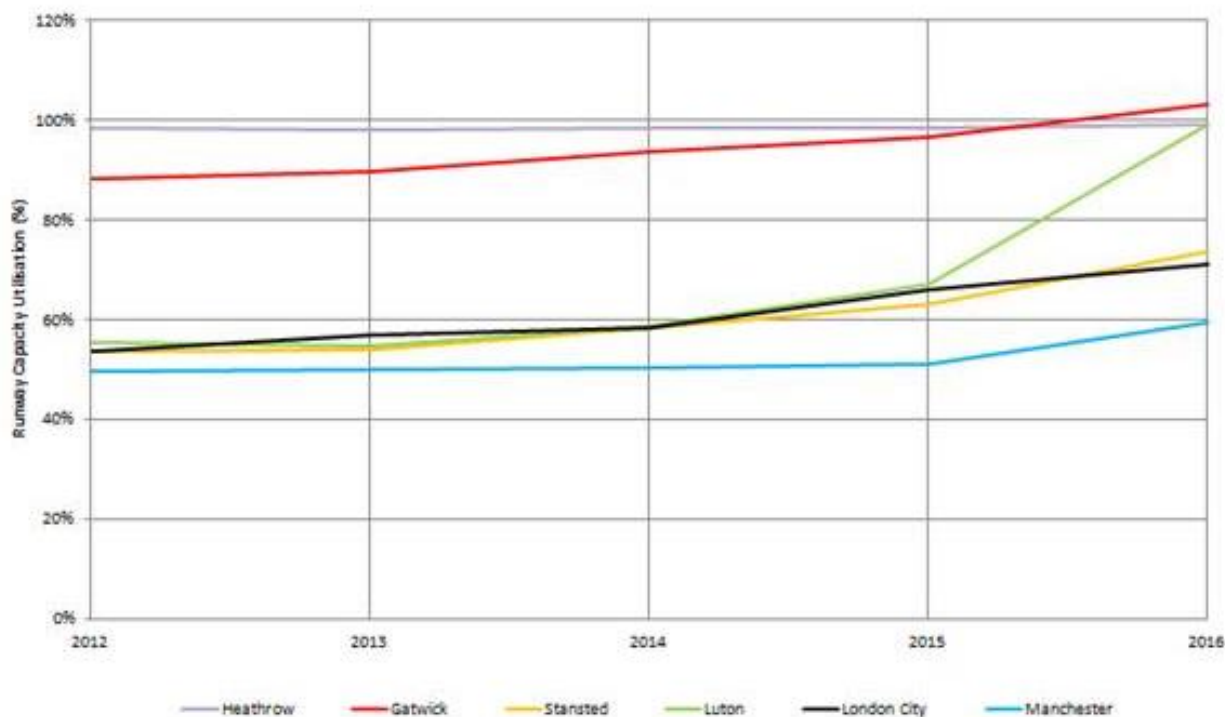
Source: ATM capacity: Airports Commission. Actual ATMs: CAA statistics.

8.   In the peak summer months, many airports experience even higher utilisation; for example, Gatwick and Manchester handled over 20% more flights in August 2016 compared to an 'average' month. During peak periods, on-time performance is often significantly lower; for example, in 2015 Gatwick achieved 57.2% during August compared to 68.7% for year overall, whilst Manchester achieved 70.7% compared to 75.6%.

9.   Airlines, airports and air traffic control are continually improving their processes to reduce delay and improve resilience. However, the overall effect of these efforts, particularly in the South East, has often been to

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[4] Heathrow has a limit set by the Terminal 5 planning inquiry of 480,000 aircraft movements per annum, but other airports are typically only limited by the number of flights they believe their runways and other infrastructure can cope with. The annual movement capacities used in Figure 2 are those assumed by the Airports Commission for its traffic forecasting.

[5] Airports Commission 2011 base line airport capacity assumptions.

increase the number of services offered alongside an overall decline in on-time performance.

10.   As airports approach capacity, it appears that the industry is faced with a trade-off on behalf of passengers between more choice, frequency or competition against less uncertainty, fewer delays and cancellations or higher costs. There are many factors which affect delay, some of which are outside the control of airports and airlines (for example, weather effects and issues in air traffic control from around Europe). Whilst some issues are outside the control of industry, there is a need anticipate issues and create resilience in operations to deal with these events.

CAA research

11.   The CAA has undertaken three pieces of research which have informed our conclusions including investigating consumer attitudes to disruption, a consultation request for information and a study into delay causes at Gatwick Airport.

12.   The CAA commissioned a piece of qualitative consumer research[6] to update and expand its existing evidence in order to provide a particular focus on consumers' views on *day-to-day* journey disruption, as well as the effectiveness of operational planning and specific intelligence on consumers using four London airports: Heathrow, Gatwick, Stansted and Luton. The research indicated that:

- Consumers generally considered the current situation acceptable in terms of the delays they experience, although they would be concerned if those delays were likely to increase.
- On the whole, they prioritised cost and convenience over delays, and would be unwilling to trade-off extra flights for better performance. This may be driven through a lack of certainty that delays would actually be avoided even if a cost/convenience price were paid.
- Increasing scheduled block times would just hide delay and they would still be experienced e.g. queuing on a taxiway.

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[6] CAP1472 Consumer attitudes to journey disruption: A qualitative research report

- They would be willing to consider (slightly) increased fares if that increased the resources (e.g. ground handlers) used to combat delays.
- Consumers value greater information provision when they are experiencing delays.

13. In June 2016 the CAA published CAP1420, 'Operating resilience of the UK's aviation infrastructure: A request for information'[7]. We explored two key areas from a UK perspective, recognising that the issues are likely to be more severe in the South East of England.

- How can the performance of the aviation network be improved or optimised?
- How effective is the current regime, and how are consumer interests represented?

14. The main relevant issues raised by stakeholders were:

- The lack of airspace capacity and need for modernisation, both in Europe and the UK.
- The need for better collaboration / co-operation, particularly where resources – runway capacity, ground handling capability, airspace, etc – were in short supply.
- Mixed views about the airport capacity declaration process, with some stakeholders feeling that the UK process 'led the world' whilst others had reservations about whether it prioritised greater utilisation at the expense of worse resilience.
- That there were weak links in the aviation system which impacted resilience, for example, competition between ground handlers.

15. In December 2016, in collaboration with Gatwick airport and the Airport Operators Committee, we commissioned an independent Gatwick Delay Causation study[8], which found that:

- Gatwick is growing but punctuality is reducing

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[7] www.caa.co.uk/CAP1420
[8] CAP 1516 Gatwick Airport Delay Root Cause Analysis, April 2017 – PA Consulting

- With its current infrastructure, Gatwick's runway utilisation is near, and at times exceeds, capacity – in recent summer seasons, the holding assumptions used for capacity planning are being regularly reached for arrivals and breached for departures.

- Short turns[9] are very challenging – airline schedules are predicated on short turns, but more often than not, these are not achieved.

- First wave[10] performance underpins performance for the remainder of the day – there is a strong statistical relationship between the punctuality of the first wave and that of the remainder of the day, maybe unsurprising in an airport where most of the flights are short haul.

- Holding on stand is severely affecting punctuality, especially first wave – the principal causes appear to be Air Traffic Flow Management (ATFM) holding (due to constraints in European airspace or at the destination airport), and Start Delay, the elapsed time between the pilot asking permission to start and air traffic control granting it.

- High levels of utilisation need optimised planning and operations – the report recommends improving the planning process, building 'headroom' into the schedule, investigating further the causes of ATFM and Start Delays, and enhancing the data collection system.

16. From the evidence that we have collected – that increased utilisation often leads to increased delay; that consumers currently are aware of acceptable levels of delay but are nervous of any increases; of the incentives and practices of the UK's busiest single runway airport and its airlines not being sufficiently aligned to control delays – it appears that there is a tension between capacity provision and delay. However, as demand increases, there is a growing risk that consumers will suffer and the incentives in the industry may not be currently aligned in such a way as to promote outcomes that are in the consumer interest.

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[9] The time between an aircraft arriving on the stand and departing on its next flight.
[10] Flights scheduled to depart from Gatwick before 09:00 local time, using an aircraft not previously having departed from or arrived at Gatwick on the same day.

Capacity Planning and Scheduling

17.   The maximum number of flights operated at an airport, although it may be influenced by planning limits or local authority agreements, is mainly dictated by the airport capacity declaration process. The rules for this are derived from the International Airline Trade Association (IATA) guidelines, but in the UK they are set by the EU slot regulation[11] as implemented by the Airport Slot Allocation Regulations 1993. This latter piece of legislation makes the airport operator solely responsible for declaring capacity, which is based on a number of assumptions and rules such as the levels of delay expected. The airport operator consults with its coordination committee which consists of airlines, air traffic control and the slot coordinator. There are different levels of process maturity across different airports in the UK.

18.   Once capacity is declared at an airport, it is allocated to individual airlines by the slot coordinator, and, once an airline has used the capacity it is entitled to retain it in future seasons provided it keeps up a certain level of utilisation. Therefore, at airports where slots are in demand, capacity, once used, will be difficult to subsequently reduce even if it would benefit consumers and other users of the airport to do so.

19.   Airlines are responsible for their own scheduling assumptions, including the time taken to fly between destinations and to prepare an aircraft for its next flight (called the turn time). Airlines are advised by the airport on the time they should allow for taxiing, etc. but there are currently no comprehensive checks on whether they follow this advice, nor how achievable their schedule is given the likely congestion at the airport.

20.   Similarly, airspace usage is planned with little formal connection between the assumptions and outcomes used by airports and airlines. This situation is improving and NATS enroute operation has begun to request individual airport schedules when it plans its operation. However, currently this only works one way – the enroute airspace controller takes account of the schedules of the airports and airlines, but there is no way for capacity limits on particular routes or pieces of airspace to be recognised in the various plans of those that use it.

[11] European Regulation 95/93/EEC ('the EU Slot Allocation Regulation'), as amended by Regulation 894/2002/EC and 793/2004/EC.

21.　In conclusion, resilience is only likely to be maintained if it is allowed for somewhere in the scheduling process. In normal competitive circumstances, we might expect that the potential success of a more reliable competitor would give all players the incentive to provide reasonable level of service. However, where capacity is scarce, new entrants struggle to get a foothold, and so this pressure is weakened. Further, delays may arise from factors outside any one player's control whilst resilience is likely to be shared by all, meaning that there is no guarantee that resources 'spent' on resilience will be reflected in better performance than competitors, nor that this will be recognised by consumers.

22.　Airline, airport and airspace scheduling processes also happen independently with no mechanism (either regulatory or market) to coordinate them.

Operational Consistency

23.　Once the operational plan comes to be implemented, it can be affected by a variety of controllable and uncontrollable factors. Controllable factors can include operational behaviours, targets, resourcing levels or physical infrastructure. Uncontrollable factors can include weather, disruption outside the UK (to European airports or air traffic control) or security alerts.

24.　Even if the plan itself is achievable, then it can be derailed by these operational factors, and the greater the capacity utilisation, the less chance there is for it to recover for the remainder of the operational day. For controllable factors, there needs to be more focus on controlling them, whereas uncontrollable issues need to be anticipated and planned for.

25.　In addition, consumers have indicated that they cope better with disruption when they feel better informed about its cause and likely duration.

26.　In the first instance, industry has an opportunity to address how to manage and improve resilience as it is aware of the causes and potential solutions. If this is not successful, broader consideration will be required of more radical options by other parties.

Conclusions

27.   There are currently no collective rights and responsibilities concerning resilience in the aviation system, potentially leading to inefficient outcomes for the industry and consumers. Indeed, there are many complexities, such that it may be difficult for a single entity to guarantee improvements to its own operation, even where it chooses to spend more money on resilience.

28.   The CAA believes that, in the period up to and following the provision of new runway capacity in the South East, action needs to be taken to mitigate the risks to consumers arising from resilience which we have highlighted in this report.

29.   Given resilience problems are likely to require collective cross industry action to resolve, in early 2017, the CAA decided to test industry appetite for forming a voluntary group to consider how best to tackle these issues. In April 2017 a group of airports and airlines based in the congested South East of the UK, along with NATS, ACL and the CAA formed the Voluntary Industry Resilience Group (VIRG) to pool their expertise and recommend actions (for industry itself or the Government's expected review of Aviation Strategy) to address current and future resilience issues.

30.   Notwithstanding the recommendations of the VIRG, there are still opportunities for the CAA to consider or formalise resilience issues through the appropriate airport economic licence process. However, CAA regulation may not be the most appropriate mechanism, as for airports it only applies currently at Heathrow and Gatwick and in general we can only introduce licence conditions at airports where we have deemed that they have sufficient market power to require a licence.

31.   The CAA could also consider NERL licence conditions to cover traffic prioritisation, airspace change, airport schedule oversight and staffing level resilience. Any such changes must be implemented through the appropriate licence process involving consultation with NERL and its stakeholders, and considered in the context of relevant European wide airspace targets.

32.   Government intervention would take time, and there is an opportunity as a likely new aviation strategy and legal arrangements for a new runway are developed. The CAA believes that the Government should consider options

for structural reform as it develops its aviation strategy. In particular what beneficial changes (if any) could be made to the airport capacity declaration responsibilities (or oversight) or to the UK slot legislation, and the potential benefits of a network system manager who could plan, co-ordinate and make decisions to improve resilience.

33.   The CAA also intends to review its information duties and punctuality statistics reporting during 2017 and could take the opportunity to introduce new or modified measures that better capture resilience or the factors which affect it.

Chapter 1

Introduction and document structure

- **Our airport and airspace capacity is constrained, and there will be no new significant airport capacity for at least 10 years.**
- **Our busiest airports are regularly among the worst performing in Europe in terms of on-time performance.**
- **Passengers benefit from increases in capacity utilisation but also suffer if that leads to more delays.**
- **We need to consider if current rules and practices reflect the consumer interest.**

Introduction

1.1   The number of passengers using the UK's airports has grown significantly since the beginings of commercial aviation in the 1940s. There has been steady growth with relatively few declines, the most significant being the global recession at the end of 2008 as illustrated in Figure 3. In terms of passenger numbers we have now recovered from this, although in terms of movements we are still well below the peak before the recession.

1.2   Aviation relies on the limited resource that is airspace and airport infrastructure to ensure that passengers, businesses, the military and leisure flyers enjoy the many benefits aviation brings.

Figure 3: Aviation growth 1950-2016
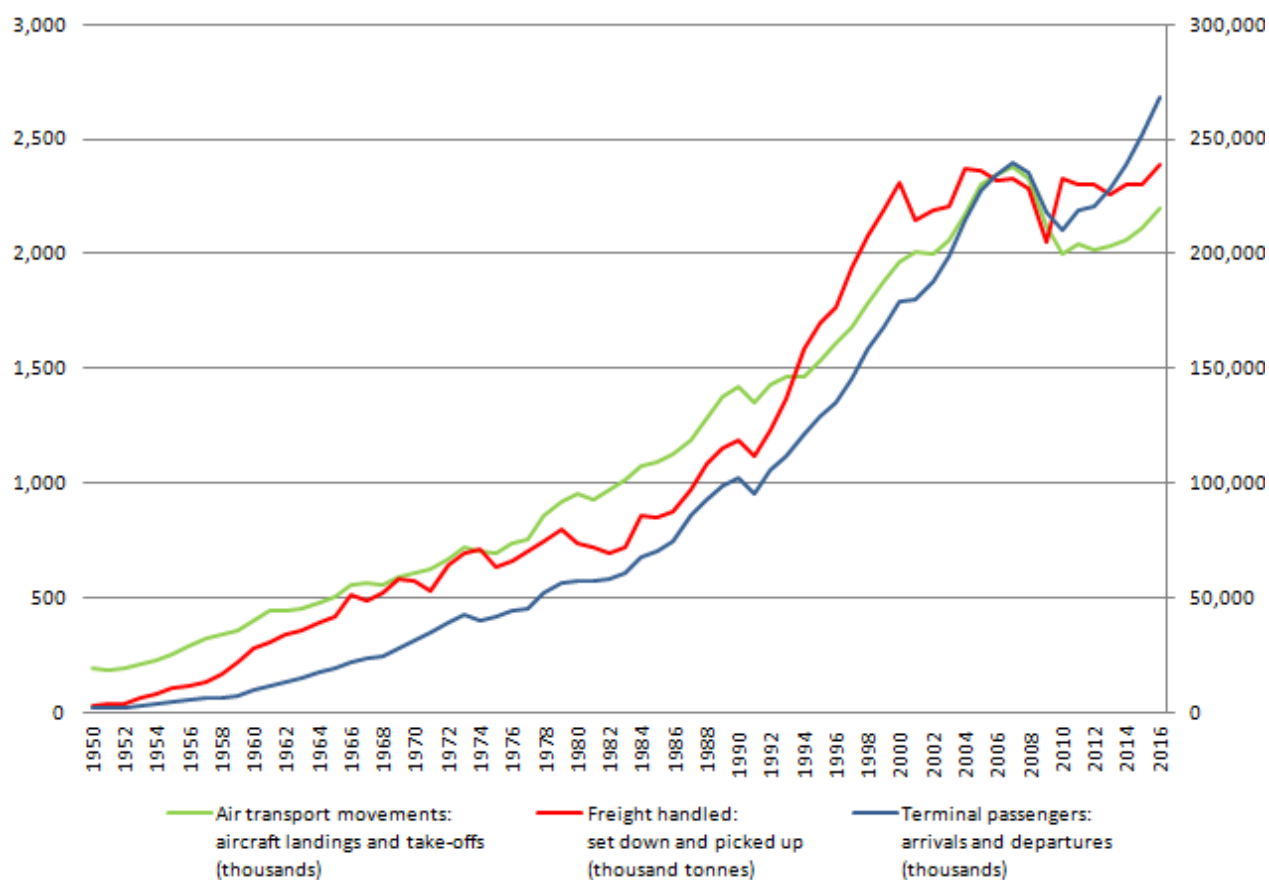
Source: CAA Statistics

1.3   The basic structure of the UK's airspace was developed over forty years ago. Throughout Europe there is a move to simplify and harmonise the way airspace and air traffic control is used through the Single European Sky project. In the UK and Ireland we're meeting those and other issues through the Future Airspace Strategy (FAS) which sets out a plan to modernise airspace. FAS is a collaborative initiative between a range of stakeholders which sets the direction for modernisation, but does not include details or recommendations about specific structures or flightpaths. For more information see www.caa.co.uk/fas/.

1.4   In recent years some of the UK's airports, particularly those in the South East of England have seen numbers of flights in excess of any comparable

city in the world[12] and London has one of the world's busiest airspace systems[13]. Although the UK Government has recently announced support for a third runway to be built at Heathrow, this new capacity is unlikely to become operational in London until 2025 at the earliest.

1.5   With passenger demand increasing, airports and airlines will attempt to accommodate as much as possible whilst maintaining an acceptable level of service. However, since individual airports operate within a system, levels of 'controllable' delay (from factors not external to the UK system – see figure below) can increase as a result of individual or local issues, or as a consequence of others' decisions operating within the system.

Figure 4: Controllable and uncontrollable delay

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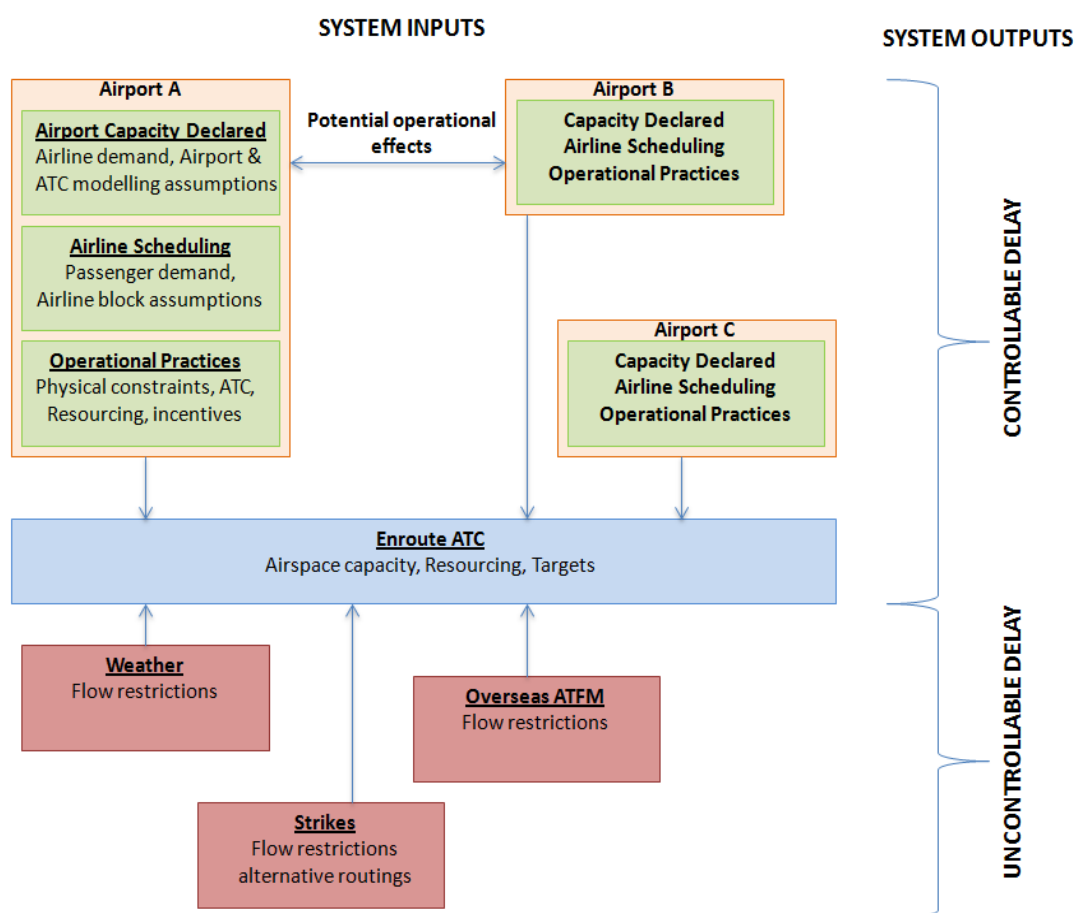
[12] In terms of aircraft take-offs and landings, Heathrow is the busiest 2-runway airport and Gatwick the busiest 1-runway airport in the world.

[13] Although in 2015 total ATMs in the rest of the UK were still 20% below the peak 2007 level, the London airports served only 2% fewer ATMs than at their peak.

1.6   Some UK airports are regularly listed amongst the worst performers in terms of delay and on-time performance in Europe by Eurocontrol as illustrated in Tables 1 and 2 for 2016.

Table 1: All Causes Delay, Top 10 affected departure airports, 2016

Rank	Departure Airport	Delayed Departures (%)	Average Delay per flight (mins)	Average Delay per flight change (%)	Average Delay per delayed flight (mins)
1	LONDON GATWICK	59.2%	19.2	22%	32.5
2	LONDON LUTON	59.2%	18.6	32%	31.5
3	MALAGA	52.1%	16.3	31%	31.2
4	BARCELONA	49.5%	15.6	41%	31.6
5	PALMA DE MALLORCA	49.0%	15.3	26%	31.3
6	ALICANTE	49.7%	15.2	-	30.6
7	ROME FIUMICINO	58.5%	14.6	-24%	25.0
8	TEL AVIV BEN GURION	48.3%	14.5	-	30.1
9	MANCHESTER	48.9%	13.7	2%	28.0
10	PARIS CHARLES DE GAULLE	52.0%	13.6	20%	26.1

Source: CODA: All-Causes Delay and Cancellations to Air Transport in Europe – Annual 2016

Table 2: All Causes Delay, Top 10 affected arrival airports, 2016

Rank	Departure Airport	Delayed Departures (%)	Average Delay per flight (mins)	Average Delay per flight change (%)	Average Delay per delayed flight (mins)
1	ISTANBUL ATATURK	62.2%	21.1	1%	33.9
2	LONDON GATWICK	49.8%	20.2	22%	40.5
3	TEL AVIV BEN GURION	60.3%	19.4	49%	32.2
4	BARCELONA	46.6%	16.9	42%	36.2
5	ALICANTE	40.3%	16.4	76%	40.8
6	LONDON LUTON	46.4%	16.3	29%	35.2
7	MALAGA	43.8%	13.5	34%	30.9
8	PORTO	43.8%	13.3	21%	30.5
9	MANCHESTER	40.1%	12.9	8%	32.2
10	LONDON HEATHROW	39.6%	12.7	-3%	32.2

Source: CODA: All-Causes Delay and Cancellations to Air Transport in Europe – Annual 2016

1.7   UK airports, their airlines and air traffic control have implemented a number of measures to improve on-time performance: those to encourage better planning, such as Airport Collaborative Decision Making (A-CDM); those to allow for more activity, such as Time Based Separation (TBS); and those which provide more of a buffer to soak up delays, such as lengthening turnaround and flight times.

1.8   The runway capacity of the major London airports has increased over the years as new techniques have been developed to safely take off and land aircraft more intensively. For example, Table 3 shows the actual and assumed runway capacities for Heathrow and Gatwick since the RUCATSE study in 1993.

Table 3: Heathrow and Gatwick Capacity Forecasts vs Actual Movements

Annual Air Transport Movements	RUCATSE 1993	Air Transport White Paper 2003	Airports Commission 2015
Heathrow			
2000	410	*460*	*460*
2005	410	480	*472*
2010	410	480	*449*
2015	410	480	*472*
2020	410	480	480
Gatwick			
2000	220	*251*	*251*
2005	220	260	*252*
2010	220	260	*234*
2015	220	260	*263*
2020	220	260	280

Notes: figures in black are forecasts, those in *blue* are actuals – 2010 throughput was affected by airport closures due to snow and volcanic ash.

1.9   Future developments in the aviation industry are likely to put more challenges on airports' resilience. Increasing passenger demand with constrained runway capacity tends to lead to larger aircraft sizes, which may require greater separation times and decrease the efficiency of the runway. Also as demand grows at all airports in the London area, the airspace around London will become more difficult to manage and

therefore may add delay to flights; this effect could be exacerbated by increasing use of business jets from smaller airports in the south east of England.

1.10   Passengers benefit from the provision of more flights, even as they suffer from any increase in delays that occur as a consequence. Therefore there will be circumstances where an increase in delay is 'a price worth paying' to obtain extra flights. In considering whether the level of capacity produces results in line with the passenger interest, it is necessary to have some understanding of how passengers value delays and capacity.

1.11   Where demand is high, the rules of slot allocation can mean that decisions to increase capacity cannot easily be reversed, even in cases where it may be beneficial for the consumer and the industry that they are reversed.

1.12   In the CAA's Strategic Plan for 2016-2021, we committed to thinking creatively about how existing capacity can be planned and operated to meet stakeholders' expectations, and what the CAA can do to ensure that resilience issues are addressed.

1.13   In that context, this paper examines the current balance of delay and punctuality against the number of flights, particularly in the planning and operational processes that the industry undertakes, and comments on how it reflects the consumer interest.

Figure 5: Trade-offs
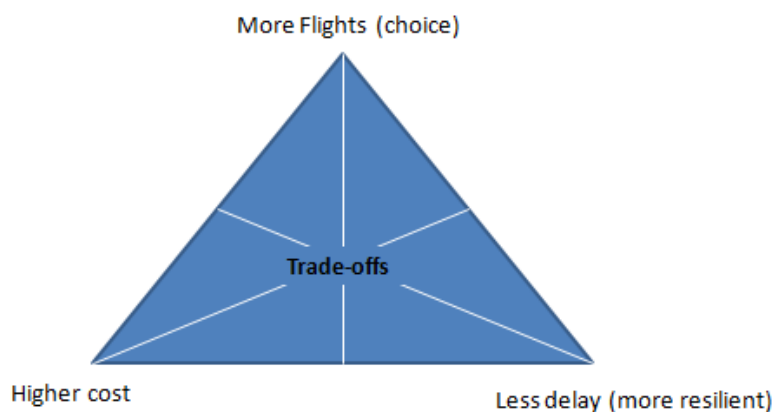
Structure of this document

1.14   The remainder of this document is structured as follows:

- Chapter 2 considers the different types and measures of delay, delay and capacity relationships and an overview of consumer interest.

- Chapter 3 summarises CAA's recent research in these areas.

- Chapter 4 examines the rules and practices of how an airport decides upon the runway capacity that it can operate within any planning limits, how airlines secure and schedule take-off and landing times, and how that process differs at different airports. We also look at the potential risks and options for change in the process.

- Chapter 5 considers how operational practices may not be consistent with the planning and scheduling process, and consider potential risks and options for change.

- Chapter 6 draws conclusions and sets out a way forward for industry, Government and the CAA to protect consumer interests in the coming decade.

Chapter 2

Delay

- **Passengers can be affected by different types of delay even if their flight is considered to be on time.**
- **Consumers have access to a wide range of data sources but these can be difficult to understand.**
- **A lack of capacity (both infrastructure and resources), variability and prolonged high utilisation can lead to increasing delays, reduced on-time performance and difficulties in recovery.**
- **On-time performance has been decreasing and delays have been increasing in recent years, and although the UK is not the worst performing in the world, there is room for improvement. The effects of airport and airspace capacity constraints are evident in other countries such as US and China.**
- **As airports approach capacity, the industry is faced with a trade-off on behalf of passengers between more choice / frequency / competition vs uncertainty / delays / cancellations / costs.**

Types of delay

2.1   According to the dictionary, delay is "a period of time by which something is late or postponed"[14]. However, in the context of a flight, there are many different ways in which delay could be, and is, experienced.

- Passenger ticket times – departure and arrival at terminal gate. The departure and arrivals times shown on a flight ticket or itinerary are the times that the aircraft should leave or arrive at the terminal gate. In the UK, and many other countries, airlines generally report being 'on-time' as early or within 15mins of the scheduled aircraft arrival or departure time.

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[14] Oxford English Dictionary

- Passenger waiting and queue times exceeding expectations (irrespective of ultimate time of arrival) at security, the gate, on the aircraft waiting to take-off, baggage reclaim or at immigration.

- Holding on the ground or in the air, as air traffic control (ATC) implement procedures to alleviate over-congestion in certain blocks of airspace.

2.2　These definitions of delay are measured and reported publicly by the aviation industry in a variety of different places, although the definitions can sometimes be complicated:

- UK CAA reports average delay per flight and 'on-time performance' [15] (proportion of flights no more than 15 mins late) at 25 UK airports. The data which the CAA receives from UK airports to calculate its punctuality statistics relate to when aircraft reach the runway for landing or take-off. This is not the same as the time of passenger arrival or departure at the terminal as referred to in the EU's Denied Boarding Legislation. The CAA uses average taxiing time to convert from runway times to terminal times.

- Eurocontrol Central Office for Delay Analysis (CODA) reports aggregated delay, including delay reason code, and on-time performance for all flights of largest EU airlines and largest EU airports. Delay is calculated by comparing latest scheduled arrival/departure time at the terminal with the actual performance. However CODA often quote 5 mins rather than 15 mins as a threshold to report on-time performance.

- OAG publishes On-time departure performance (proportion of flights no more than 15 mins late) for global airlines and airports. 'On time' is defined as departures that take place strictly less than 15 minutes after schedule for airports. For airlines, 'on-time' is defined as arrivals that take place strictly less than 15 minutes after schedule. 'Schedule' is defined as what has been provided by airlines to the OAG

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[15] It should be noted that different airline business models may result in a difference in OTP. Airlines may choose to increase the scheduled time between the flight departure and arrival (the block time) to take into account congestion or to improve flight connection performance. However, passengers may still perceive queuing or waiting as a delay.

database. To qualify for inclusion in the OAG Punctuality League, the OAG database must have received data for at least 80% of scheduled flights operating to and from an airport. OAG provide an analysis of small, medium and large airports as well as different airline categories and by region.

- Third parties like flightstats.com provide search facilities where consumers can search live flight status and historical delay and cancellation statistics by region, airport, airline or route. The statistics are based on a wide range of data feeds (including airports, airlines, Global Distribution Systems and positional data sources), which are used to power many developer and customer mobile apps.

- NATS[16] report 'ATC caused [enroute] delay', which is delay attributable to the performance of NATS and is broken down into capacity or staffing reasons. NATS also compare this with data from Eurocontrol to show how NATS and the UK perform relatively.

- Eurocontrol also now publish congestion related indicators of delay in support of COMMISSION REGULATION (EU) No 691/2010 which lays down a performance scheme for air navigation services and network functions. These indicators include Arrivals Sequencing and Metering Area (ASMA), Airport related Air Traffic Flow Management (ATFM) delay, ATC pre-departure delay and Additional Taxi out time. These indicators are useful in comparing airport performance as they can illustrate congestion effects at an airport.

- Airports produce a variety of statistics – for example, Gatwick publishes monthly reports of on-time performance (proportion of flights no more than 15 mins late compared to scheduled terminal arrival/departure) as well as targets for security queuing, baggage handling and availability of pier served stands.

2.3   In the following sections we will generally refer to on/off stand delay (i.e. the delay compared to the purchased ticket times) of which other delays may be a contributing factor. For example, a passenger delayed at security

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[16] NATS (formerly National Air Traffic Services), the biggest air navigation service provider in the UK, parent company of NERL (NATS En Route plc) and NSL (NATS Services Limited). www.nats.co.uk

may cause the aircraft to be delayed moving off stand. Or air traffic flow restrictions due to lack of staff resources in another country may delay a flight arriving on stand in the UK. Although these delays may cause passengers stress, it is generally the arrival time at the destination which is seen as most important to passengers (as indicated in our consumer research, described in Chapter 3).

2.4   Figure 6 shows average delay at the UK's six coordinated airports between 2012 and 2016. All with the exception of Heathrow and Manchester have suffered significant increases in delay over that period.

Figure 6: Average Delay (mins), 2012-2016
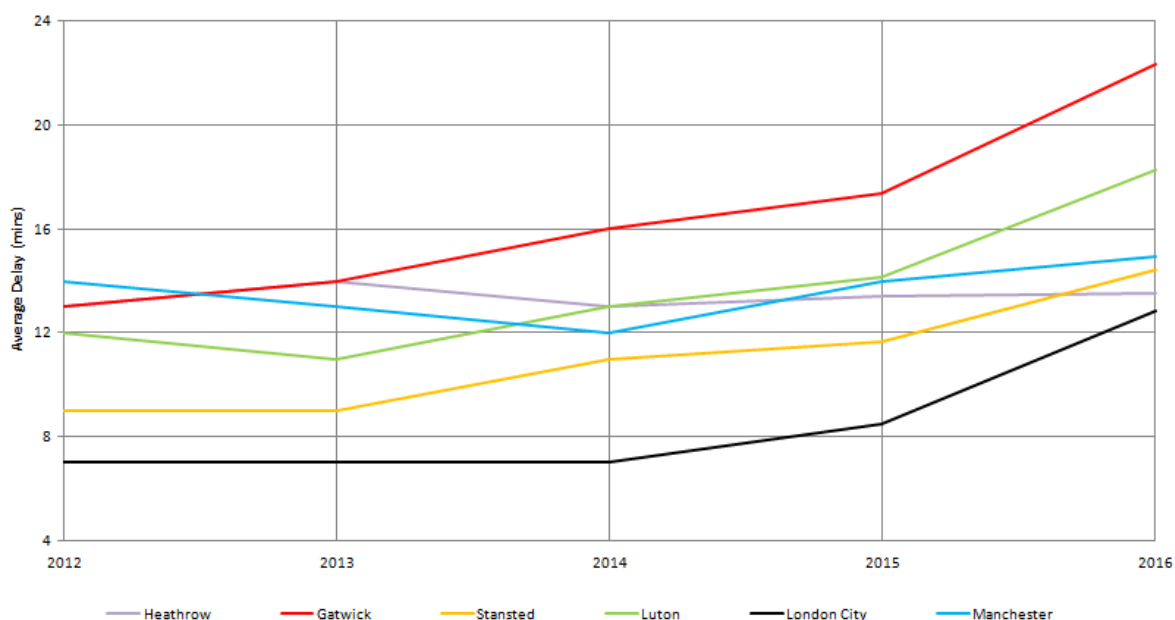
Source: CAA Statistics

2.5   Figure 7 shows the corresponding on-time performance between 2012 and 2016 as calculated by the CAA. Heathrow and Manchester have remained relatively static, and London City has seen imp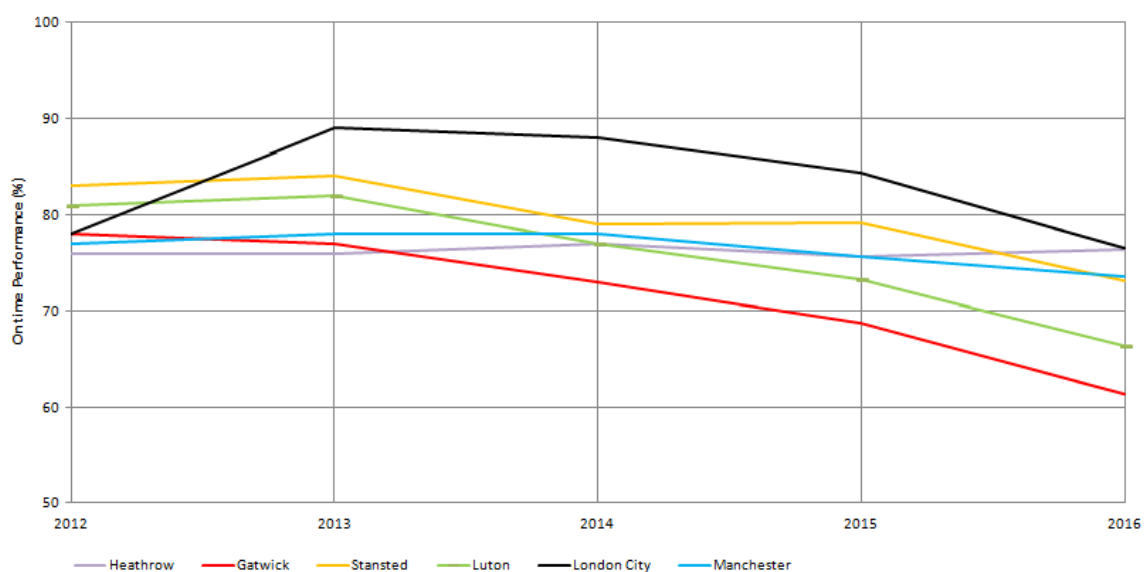rovements in 2013 which have since been eroded. Other airports, in particular Gatwick and Luton have seen on-time performance deteriorate.

Figure 7: On-time Performance, 2012 - 2016

<p align="right">Source: CAA Statistics</p>

2.6 Whilst the majority of UK flights are considered to be 'on time'[17] the average delay for a delayed flight is more likely to be up to 60 minutes[18]. Passenger who suffer long delays over 3 hours or cancellations are entitled to compensation under EU regulation 261.

2.7 Delay reasons are reported by airlines using standard IATA delay codes covering categories such as weather, airline related, airport related, air traffic flow restrictions.

2.8 However these do not necessarily provide the root cause of the delay in all cases, which may be related to fundamental capacity, planning/scheduling or operational practices which was the subject of our Request for Information, discussed further in Chapter 3.

Capacity and delay relationships

2.9 Basic queuing theory suggests that higher utilisation and variability lead to waiting. This is the same for any service with a finite capacity, for example queuing on busy roads, shops or hospitals.

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[17] For reporting punctuality 'on-time' is considered to be early or up to 15mins late
[18] CAA punctuality statistics

2.10   Prolonged high utilisation and variability can exacerbate delays, after which recovery is only possible when utilisation drops low enough to allow queues to dissipate. These periods of recovery are sometimes referred to as fire-breaks, and if there are none then delay tends to build up during the day.

2.11   At airports, variability (for example, through late arrivals and departures) and inability to recover (for example, through high runway utilisation) can extend pressure onto others who are acting in a system, such as airline crew, ground handlers, other airports and air traffic controllers. This also works both ways with, for example, the capacity of others in the system such as air traffic controllers, ground handlers can extend pressure onto an airport's physical infrasture and operation. It is therefore difficult for one enitity to guarantee high levels of service when there are many involved in the overall system.

2.12   Such delays may not always be evident when comparing on-time performance, as airline schedules can include buffers[19] where delays are expected. Airline business models may dictate whether buffers are used. For example, short haul low cost carriers may rely on high daytime aircraft utilisation and short turnaround times, whereas long haul network carriers may build in more buffer time to provide reliability for their customers, particularly if they have booked onward connections.

2.13   It is therefore useful to consider other congestion performance indicators as well as on-time performance when looking at the effects of high utilisation. In December 2016 the CAA commissioned an independent study[20] at Gatwick Airport to review the causes of delay. This illustrates the relationships between capacity, scheduling assumptions and delay, and is summarised in Chapter 3

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[19] Extra time built into the scheduled flight duration.
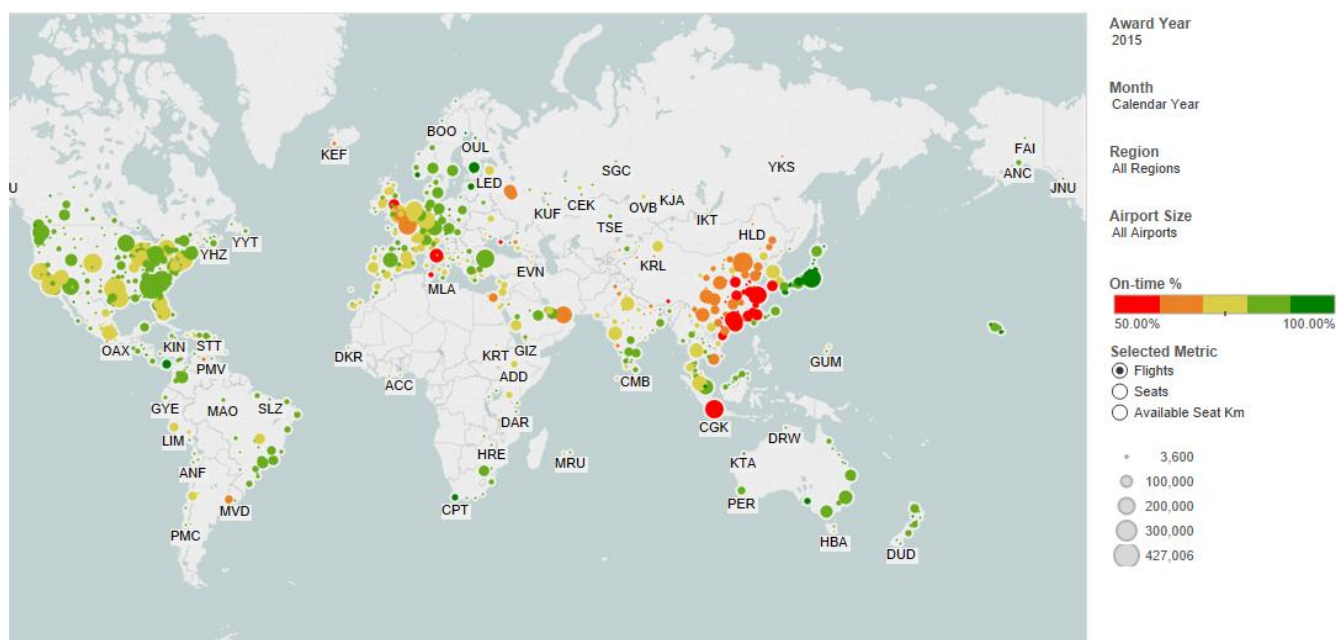[20] CAP 1516 Gatwick Airport Delay Root Cause Analysis, June 2017 – PA Consulting

International comparators

2.14   In general, US airports are theoretically able to achieve higher capacities, in terms of hourly aircraft runway movements, than their European counterparts.

2.15   This is due to different separation standards and weather permitting, the use of visual approach procedures (known as VFR or Visual Flight Rules).

2.16   In addition, most US airports do not have slot constraints on the number of movements that can be scheduled at airports. The concept of "declared capacity" is not used. The scheduling of flights at airports is not constrained, and an airline may schedule a landing or takeoff at any time it wishes, as long as it can obtain access to a terminal building and aircraft stand. The exceptions are the New York airports (JFKennedy, La Guardia and Newark) where the Federal Aviation Administration (FAA) imposes scheduling limits in order to mitigate congestion.

2.17   However, a joint Eurocontrol/FAA report published in 2013[21] provides a useful insight into the role of capacity on operational performance. It suggests that US airports suffer from increased service disruptions compared to European airports, as demand is greater than capacity when weather conditions deteriorate.

2.18   European airports, on the other hand, generally have improved schedule predictability by using slot controls and by determining the number of available slots with reference to airport capacities under instrument meteorological conditions.

2.19   Airspace capacity is an issue for Chinese airports which have some of the worst delay performance in the world. The majority of Chinese airspace is currently controlled by the military leaving little room for civilian aircraft as their domestic airline industry has boomed.

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[21] Joint Eurocontrol / FAA Report: Comparison of Air Traffic Management-Related 2013 Operational Performance: U.S./Europe

2.20   Japan has dominated the flightstats on-time performance awards with nine
         of its airports in the top 10 in 2015 achieving greater than 93% of flights
         arriving and departing on time. Japan's airlines also do well, with both
         Japan Airlines and ANA in the top six international carriers in 2015 and
         2016

2.21   OAG[22] puts Japan's good performance down to the country's timekeeping
         traditions as well as long experience handling larger aircraft for domestic
         flights. When winning the award in 2009, the JAL Group explained[23] how it
         established an On-Time Performance Project which sought to involve all
         Group employees by soliciting ideas to improve on-time performance while
         maintaining strict safety standards.

Figure 8: 2015 Airport On-time Departure Performance: All Regions

Source: Flightstats

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[22] http://edition.cnn.com/2016/01/06/aviation/most-punctual-airline-and-airports-2016/
[23] http://press.jal.co.jp/en/release/201004/003281.html

Passenger Interest

2.22   Capacity or connectivity incorporates many aspects of choice and value that drive the consumer benefits of aviation. This includes the degree of choice available to consumers in terms of origin airport, airline and destination, as well as affordability.

2.23   The value placed on a particular service or destination may vary depending on the individual trip type (leisure, business or visiting friends or relatives) and convenience offered (airport, direct/indirect service, frequency of service).

2.24   Previous passenger preference evidence[24] suggests that passengers value the location of the airport and route availability, as both of these factor highly in reasons for airport choice.

Figure 9: Reason for airport choice
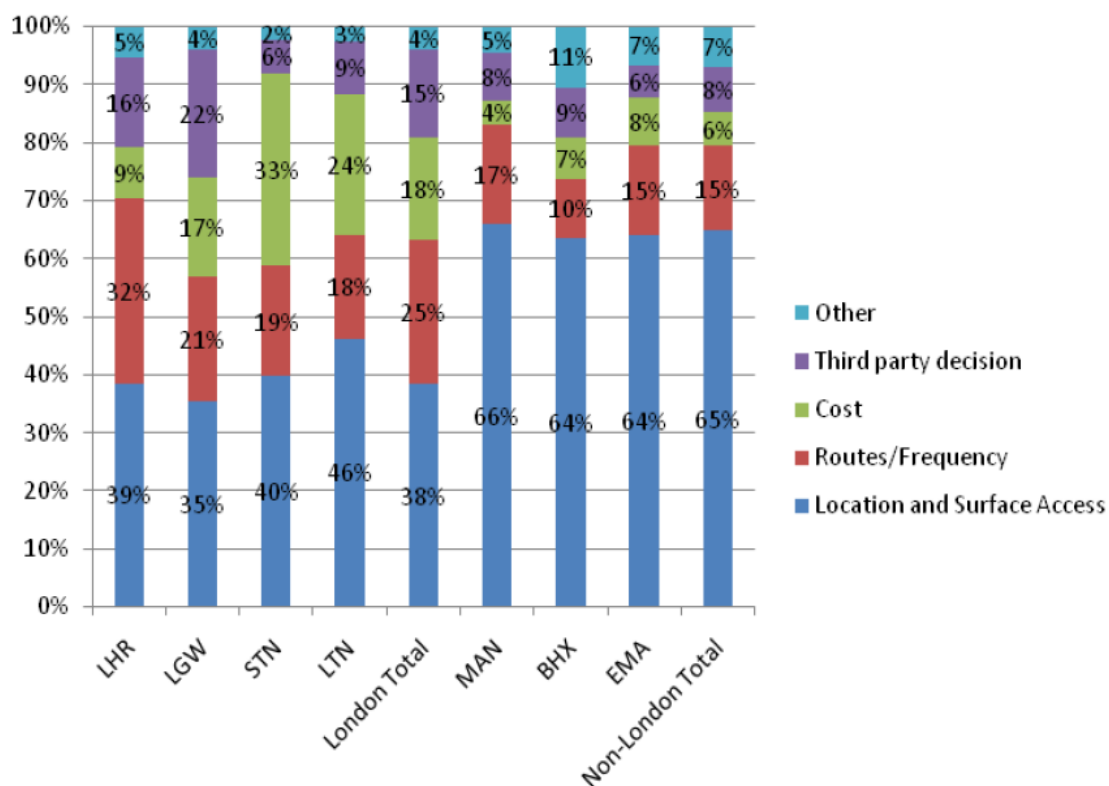
Source: CAA Passenger Survey Working paper November 2011

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[24] For example 'CAA Passenger Survey Working paper November 2011'

2.25   Consumers value the range of destinations that they can access, whether they are travelling for business or leisure purposes. For some consumer groups, service frequency is important in providing flexibility to their travel options. The range of destinations and the frequency with which they are served are key aspects of connectivity. Where destinations are not served directly, or only infrequently, indirect connections through hub airports can widen the choice available to consumers;

2.26   In terms of value to the consumer, the competition that has arisen as a result of liberalisation of the European aviation market has significantly increased the affordability of aviation[25]. Competition, the flexibility to allocate seat capacity efficiently, and the availability of additional capacity to support growth are important aspects that impact upon the range of people who have affordable access to connectivity benefits.

2.27   Most passengers expect to receive the service that they have paid for at the time of booking, but some may build in some contingency or expect some delay. The value passengers place on delay depends on their value of time (VoT), who paid for ticket, what arrangements they have at the destination, or whether it is start or end of their trip.

2.28   Some passengers also experience higher stress levels when subject to queing and delays even though they may arrive at their destination on time (e.g. where an airline may have scheduled buffers to take account of delay).

2.29   The costs of anticipated delays may already be included the ticket price (lower aircraft utilisation and extra fuel burn), and the introduction of more flights can affect these costs. On the other hand, additional flights may lead to competition and lower fares.

2.30   There could be situations where capacity decisions may not be in the general interest of passengers using an airport, airline or section of airspace if these decisions result in disproportionate delays (i.e. existing

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[25] researchbriefings.files.parliament.uk/documents/SN03760/SN03760.pdf

users suffer a disproportionate increase in costs of delays for a small number of additional flights).

2.31   We have tried to understand how passengers value these conflicting options and how the aviation industry decides on the passengers' behalf. In the following chapters we discuss our findings.

Chapter 3

CAA research

- **Our consumer research undertaken in summer 2016 indicated that:**

    - **Consumers generally considered the current situation acceptable in terms of the delays they experienced, although they would be concerned if those delays were likely to increase.**

    - **On the whole, they prioritised cost and convenience over delays, and would be unwilling to trade-off extra flights for better performance. This may be driven through a lack of certainty that delays would actually be avoided even if a cost/convenience price were paid.**

    - **Increasing scheduled block times would just hide delay and they would still be experienced e.g. queuing on a taxiway.**

    - **They would be willing to consider (slightly) increased fares if that increased the resources (e.g. ground handlers) used to combat delays.**

    - **Consumers value greater information provision when they are experiencing delays.**

- **Our request for information was open from June to September 2016 and the main relevant issues raised by stakeholders were:**

    - **The lack of airspace capacity and need for modernisation, both in Europe and the UK.**

    - **The need for better collaboration / co-operation.**

    - **Mixed views about the airport capacity declaration process**

    - **That there were weak links in the aviation system which impacted resilience, for example, competition between ground handlers.**

- **We commissioned an independent delay causation study at Gatwick which found that:**

- **Gatwick is growing but punctuality is reducing.**

- **With its current infrastructure, Gatwick's utilisation is near, and at times exceeds, capacity.**

- **Short turns are very challenging – airline schedules are predicated on short turns, but more often than not, these are not achieved.**

- **First wave performance underpins performance for the remainder of the day.**

- **Holding on stand is severely affecting punctuality, especially first wave – the principal causes appear to be Air Traffic Flow Management (ATFM) holding (due to constraints in European airspace or at the destination airport), and Start Delay, the elapsed time between the pilot asking permission to start and air traffic control granting it.**

- **High levels of utilisation need optimised planning and operations. The report recommends improving the planning process, building 'headroom' into the schedule, investigating further the causes of ATFM and Start Delays, and enhancing the data collection system.**

- **Gaining insight from Summer 2017 on-time performance needs a new collaborative approach which adopts formal problem-solving methodologies.**

3.1   The CAA has undertaken three pieces of research which have informed our conclusions including investigating consumer attitudes to disruption, a consultation request for information and a study into delay causes at Gatwick Airport.

Consumer Research

3.2   The CAA commissioned a piece of qualitative consumer research[26] to update and expand its existing evidence in order to provide:

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[26] CAP1472 Consumer attitudes to journey disruption: A qualitative research report

- A particular focus on consumers' views on *day-to-day* journey disruption, caused by runway and airport congestion, rather than disruption which is related to significant adverse events, as well as the effectiveness of operational planning.

- A better understanding of informed consumer perceptions and expectations with respect to journey disruption, including once they have been exposed to materials explaining disruption and possible trade-offs to manage or reduce this.

- Specific intelligence on consumers using *four London airports*: Heathrow, Gatwick, Stansted and Luton.

3.3   A qualitative 'deliberative-style' approach was used for this research and the overall programme comprised of:

- 10 focus groups with a cross-section of local (London/South East-based) recent users of the four London airports.

- 20 depth interviews with additional specific passenger types who recently used Heathrow Airport (passengers with restricted mobility or PRM[27], international connecting passengers, domestic connecting passengers and foreign resident passengers).

3.4   This involved exposing participants to some facts on journey disruption, as well as ideas for reducing or managing disruption and the associated trade-offs, for their consideration. This material was introduced once an initial unprompted discussion of perceptions and expectations had already taken place so it would be possible to compare spontaneously held views with those that developed in response to the stimulus. The research was conducted between 16th August and 7th September, 2016 and, in total, 90 consumers took part.

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[27] These passengers are covered by the regulation EC1107/2007 which aims to ensure such people have the same access to air travel as other passengers. Article 2(a) of the Regulation defines 'disabled person' or 'person with reduced mobility' as meaning any person whose mobility when using transport is reduced due to any physical disability (sensory or locomotor, permanent or temporary), intellectual disability or impairment, or any other cause of disability, or age, and whose situation needs appropriate attention and the adaptation to his or her particular needs of the service made available to all passengers.

3.5   Overall, disruption at London airports was not spontaneously identified as representing a major, ongoing problem for passengers currently. This is partly because a certain level of journey disruption was regarded to be both inevitable and acceptable given the complexity of aviation.

3.6   There was a general consensus that 'unnecessary disruption' (for example, long security queues when not all positions are manned) was the most irritating, especially if this was associated with perceived insufficient resourcing, planning or contingency measures.

3.7   The appeal of a number of propositions was also tested, namely:

- Reducing the number of flights at congested airports;
- Increasing or moving resources to improve resilience;
- Increasing 'block times' (the time scheduled between departure and arrival of flights) to improve on-time performance;
- Improving information provision (both in the event of disruption and more general information regarding on-time performance).

3.8   Improved information provision was the most popular, although general information regarding on-time performance had limited appeal. A number of participants could see benefits from increasing or redeploying resources, although participants were polarised on whether they would be prepared to pay extra for this. Increasing block times was unpopular as it was not perceived to address the core problem and could be seen as misleading. Similarly, most rejected the prospect of reducing flights, as they would not be prepared to accept lower choice.

3.9   Overall, disruption was generally not seen to be a big enough problem currently to warrant trade-offs of either reduced choice or increased prices associated with certain remedial measures suggested. Views on this may change should disruption be seen to worsen. However, consumers would first need to be convinced that what they are 'paying for' will be genuinely effective in improving resilience.

3.10   While there was not seen to be a major problem with journey disruption currently at London airports, there was felt to be scope to make improvements in a number of areas, including:

- Ensuring efficient management of day-to-day airport processes on a consistent basis;
- Responding to pinch points and problems in a timely way, including by anticipating issues in advance wherever possible; and
- Providing good quality information and welfare to passengers in the event of disruption.

Overview of CAA's request for information

3.11   In June 2016 the CAA published CAP1420 'Operating resilience of the UK's aviation infrastructure: A request for information'[28], in which we explored two key areas from a UK perspective, recognising that the issues are likely to be more severe in the South East of England.

- How can the performance of the aviation network be improved or optimised?
- How effective is the current regime, and how are consumer interests represented?

3.12   We posed a number of questions relating to understanding the consumer interest, the planning of capacity, operational behaviours and information sharing between industry players and the consumer:

- Questions 1-4 were aimed at industry parties who plan how to use the UK's aviation infrastructure and in particular how they understand and balance aviation capacity and resilience trade-offs on behalf of passengers.
- Questions 5-13 dealt with the aviation industry decision making processes and assumptions that lead to the capacity available and the resulting airline schedules.

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[28] www.caa.co.uk/CAP1420

- Questions 14-18 covered the day to day operational challenges facing the aviation industry in the future, and what can be done to improve operational resilience.

- And Questions 19-23 were concerned with sharing information, either between different industry parties, which could help to improve planning and performance, or that may be important for individual passengers when booking or during their journey.

3.13   The request for information was published on 22 June 2016 and closed on the 30 September 2016, although a number of late responses were accepted.

3.14   The CAA supplemented the request for information with stakeholder meetings to understand potential concerns and issues in more detail. Meetings were held with Manchester Airports Group, Easyjet, Luton Airport, Gatwick Airport, Heathrow Airport, British Airways and Airport Coordination Limited (ACL).

Responses

3.15   We received 23 responses in total. We asked respondents to self-categorise in one of eight categories. Of the responses:

- The majority (14) were from the commercial aviation industry

- The next largest group were residents affected by aviation (4), followed by members of the General Aviation community (2)

- There was only one response from airline passengers, one from Government/regulators, and one who declined to categorise themselves

- Geographically, the responses were mainly from the south-east of England.

3.16   Of our 23 consultation questions, 10 included both a 'closed' and an 'open' element. Of these, in six questions, respondents were invited to choose 'yes', 'no' or 'don't know' (the 'closed' element), as well as being offered a free-text box to share their reasons and views (the 'open' element). On four of the 10 closed questions, there were specific options to choose

rather than 'yes', 'no' or 'don't know'. The remaining 13 questions were 'open' (i.e. respondents were invited to write free text). A list of respondents and a quantitative analysis of the multiple choice questions are included in Appendix A.

Qualitative analysis

3.17   Most respondents took the opportunity presented by the open text responses to share their views, evidence or rationale for their answers. Below we summarise the specific points respondents made in these open text sections.

Questions 1-4 were aimed at industry parties who plan how to use the UK's aviation infrastructure and in particular how they understand and balance aviation capacity and resilience trade-offs on behalf of passengers.

3.18   Airlines emphasised that their success (and survival) is dependent on their ability to understand and tailor their offer to consumer needs, and therefore suggested that it is only right to ensure that airlines are presented with the correct information at the declaration stage and have a voice. They explained that they are the only ones that have a contract with the consumer.

> "As an airline BA has to understand and fulfil consumer interests in order to succeed in the competitive aviation marketplace…..it is only airlines who have the commercial imperative to correctly and faithfully represent the passengers' interests in questions on capacity and resilience."

3.19   Airport operators explained that regular satisfaction surveys at key points in the passenger journey were used to monitor issues arising from these trade-offs. In addition, some airports were entering into contracts with airlines which set out explicit service and experience levels. However, airport operators were generally seen by others as more shareholder orientated, particularly where there is room to increase movements, which could create tension.

3.20   One airline who did not wish to be identified set out its views at Gatwick.

> "Gatwick's thirst for commercial growth pushes the operation into turmoil during disruption. The airlines and handling agents also have a part to play, the drive to reduce costs or win a contract leaves very little, or any margin for handling agents to build in resilience to their manpower."

3.21   Some respondents thought that there was too much emphasis on commercial traffic, rather than general aviation, particularly in the South East and that better spreading of demand should be encouraged if possible.

3.22   Residents affected by aviation thought that consumers' interests were not understood, describing aircraft noise as needing to be taking into account .

3.23   Two respondents suggested that passengers valued arrival time over anything else but at present the operation was focussed on departure punctuality as this was more controllable for airport stakeholders.

Discussion

3.24   We accept that many stakeholders (airlines and airports) do take into account passenger welfare but note that as pressures increase the differences in incentives may come to the fore.

3.25   Overflown residents are consulted when airspace changes or new infrastructure decisions are made; for other increases in traffic, their views are reflected in agreements made with local councils. For example Gatwick Airport signed a Section 106 (s106) legal agreement with West Sussex County Council and Crawley Borough Council (following consultation with seven other local authorities in the area). The agreement reflected a shared desire to see the airport grow, with measures in place to minimise as far as possible its short and long term impacts.[29]

3.26   In the South East there are capacity constraints and, where demand is high, it makes commercial sense for airport operators to utilise their infrastructure as efficiently as possible. This keeps prices lower for

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[29] For more information see http://www.gatwickairport.com/business-community/about-gatwick/corporate-responsibility/s106-action-plans/

passengers and tends to price off GA users. Some airports, such as Luton, still accommodate GA traffic albeit mainly in the off peak periods.

Questions 5-13 dealt with the aviation industry decision making processes and assumptions that lead to the capacity available and the resulting airline schedules.

3.27   The general concensus was that the airport operator was reponsible for making the capacity decisions albeit with varying degrees of collaboration. For example, at Heathrow airport, where the number of movements are close to the movement cap that is in place[30], there was evidence of much more focus and collaboration to get the best resilience outcomes. At busy airports where slots were still available, there appeared to more commercial and operational tensions.

> "Over recent years the process at LGW has diverged away from the LHR process. Stakeholders understand the implications of additional delay, but do not collaboratively discuss the solutions, nor the costs involved to adapt the LGW schedule within newly declared capacity."

3.28   There were suggestions from airline respondents that the assumptions used in the decision making process were not close to reality and that penalties should be in place if there were mismatches between planning and the operation, as well as stronger sanctions for airlines on deliberate slot abuse.

> "…when looking at key parameters and assumptions for capacity declaration, the declarations and capacity are currently determined based on 100% On Time Departures (OTD), when in practice LGW operates well below this level, in effect reducing available capacity. Historic performance should be considered as part of this process with assumptions based on a more realistic OTD performance level….an independent body should check key parameters."

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[30] Heathrow has an annual movement cap of 480,000 which was a Terminal 5 Planning condition.

3.29   Gatwick Airport's response suggested that airline scheduling was a
        problem, and in particular, that realistic asumptions on block and turn times
        needed to be used in the airline scheduling process in order to take into
        account European airspace delays and the poor performance of ground
        handlers.

> "…The scheduling process is a mechanical, rule governed process, rather
> than one characterised by 'judgements'. However, elements which are
> currently outside the process are the ability of the airlines to adhere to the
> schedule they plan to fly, the implied risk profile faced by the schedule, and
> the ability of the system to recover from events. We believe we have
> enhanced the process significantly over the past period to increase the
> sophistication of the modelling of airport demand."

3.30   There was a suggestion from the GA community that some underutilised
        airports should involve both GA and commercial users to consider
        oppportunities, and that decisions weren't necessarily transparent.

3.31   One resident affected by aviation was concerned about the additive impact
        on residential areas of different airport activity, and that there should be
        Local Authority representation in the Governance process.

Discussion

3.32   Stakeholders' views of the capacity declaration process echoed our own
        understanding of this. We noted that there were mixed opinions on the
        effectiveness of the modelling process and that, at airports where slots
        were scarce, airlines used wish lists to indicate indicate their interest in any
        new slots created even if they would prefer capacity not to be increased.

3.33   For smaller, under utilised airports[31], the extent to which to involve GA and
        commercial users in planning and decision making remains a commercial
        decision for the airport operator in the light of local circumstances.

3.34   As discussed in paragraph 3.25, local authorities are involved in agreeing
        or influencing the levels of activity at airports. The capacity declaration

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[31] Which are likely to be 'Level 1' (non-coordinated) in terms of slot coordination (see paragraph 4.3).

process is for the airport to set the level of activity within those already agreed limits depending on the demand and airport infrastructure available at the time.

Questions 14-18 covered the day to day operational challenges facing the aviation industry in the future, and what can be done to improve operational resilience.

3.35 There were a number of responses citing airspace and airport capacity in the UK, and the performance of the European network as increasingly significant issues.

"Year on year our ATC related delays have increased, and show no sign of getting any better. The government need to be more proactive with decision making when it comes to helping airports and airport infrastructure."

3.36 One airport operator suggested that other airports should improve their own processes and local rules to the benefit of the overall London system.

3.37 Two respondents suggested that commercial relationships affected the operation: for example, the incompatability between capacity declared and the attainment of airport service levels such as pier service.

3.38 One airline acknowledged that competition and the need to cut costs was likely to affect third party provider resource levels such as ground handlers, which could contribute to delay and increased recovery times.

"…The airlines and handling agents also have a part to play, the drive to reduce costs or win a contract leaves very little, or any margin for handling agents to build in resilience to their manpower."

3.39 A member of the public and the GA community thought that better use of regional airports should be encouraged, as well as the importance of the impact on the environment.

Discussion

3.40   We acknowledge that airspace issues (in Europe and at home) have affected operations especially from London airports. Throughout Europe there is a move to simplify and harmonise the way airspace and air traffic control is used through the Single European Sky project. In the UK and Ireland, this is being met through the UK's Future Airspace Strategy which sets out a plan to modernise airspace by 2030.

3.41   Between Feburary and May 2017, the Government consulted on proposals to modernise the way UK airspace is managed. The CAA is consulting on guidance to support its new airspace change decision-making process. Improvements to evidence and transparency will help us reach decisions that balance the interests of all stakeholders, including communities around airports, consumers and others who use UK airspace.

Questions 19-23 were concerned with sharing information, either between different industry parties, which could help to improve planning and performance, or that may be important for individual passengers when booking or during their journey.

3.42   A member of the GA community suggested that competition between airports was unhelpful in this area and that more coordination and collaboration was required.

3.43   One airport operator suggested that NATS should assess combined airport schedules and produce a mitigating plan where possible, and that the European Network manager could undertake a similar exercise.

3.44   ACL commented that it has recently started to provide NATS with airport schedule information to inform its forward planning and to identify hotspots for individual airports. However ACL pointed out that this does not cover all airports and the timing of information provision by airports is crucial to its success.

3.45   The Gatwick ACC believed that airports should publish a more balanced view for the consumer (rather than their core service standards) and meaningful comparisons with other airports.

3.46   A member of the public felt that information should be monitored by a third party as there was distrust, and the information published was difficult to understand. However, this comment appeared to be in relation to expansion and airspace changes rather than resilience or delays.

Discussion

3.47   Our consumer survey suggested that delay information at the point of booking was not a priority in the booking process, but consumers value information when they are experiencing delays.

3.48   Since more competition has been introduced in the London system (i.e. new airport ownership, new tower providers) there is more potential for inconsistency and so more opportunities for information sharing and collaboration in order to improve performance.

3.49   As noted by respondents, following joint industry meetings hosted by the CAA in 2016, NATS are now using schedules from all coordinated London airports to assess their overall effect on London airspace.

Conclusion

3.50   In general, responses to the request for information did not provide or cite independent evidence, but informed the CAA of the opinions of stakeholders based on their expereince. The main points can be summarised as follows:

- Agreement that the current capacity declaration process works well at Heathrow, where various parties are aligned in improving performance as opposed to being able to increase flights *(8 responses)*
- Capacity / airspace decisions should take account of more information from more/all airports *(7 responses)*
- The need for UK airspace modernisation and improvements in Europe *(7 responses)*
- Mixed views about the declaration process at Gatwick *(5 positive responses vs 5 negative)*

- Call for the effect on residents to be taken into account *(3 responses)*

- Ground-handler market is not working – they are under-resourced *(2 responses)*

- Mixed views on greater transparency of information (some agreed in principle, some that issues too complex for consumers to find useful)

- Other themes around airports' market power, incumbent airlines' incentives to protect their interests, and the use of regional and GA airports.

3.51   Some of the issues raised in response to this consultation are being addressed by other areas of our work, or are down to purely commercial decisions. We do not have powers to address others as they result from commercial and market forces, such as the distribution of commercial and general aviation traffic at airports).

3.52   However, we also believe that further investigation is merited into the planning, scheduling and operational processes, and that there are opportunities for consistency and better cross-industry collaboration. We consider these issues in more detail in Chapters 4 and 5.

Independent Gatwick Delay Causation Study

3.53   In December 2016, in collaboration with Gatwick airport and the Airport Operators Committee, we commissioned an independent Gatwick Delay Causation study[32], which found that:

- Gatwick is growing but punctuality is reducing.

- With its current infrastructure, Gatwick's utilisation is near, and at times exceeds, capacity – in recent summer seasons, the holding assumptions used for capacity planning are being regularly reached for arrivals and breached for departures.

- Short turns[33] are very challenging – airline scheduled are predicated on short turns, but more often than not, these are not achieved.

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[32] CAP 1516 Gatwick Airport Delay Root Cause Analysis, June 2017 – PA Consulting

- First wave[34] performance underpins performance for the remainder of the day – there is a strong statistical relationship between the punctuality of the first wave and that of the remainder of the day, maybe unsurprising in an airport where most of the flights are short haul.

- Holding on stand is severely affecting punctuality, especially first wave – the principal causes appear to be Air Traffic Flow Management (ATFM) holding (due to constraints in European airspace or at the destination airport), and Start Delay, the elapsed time between the pilot asking permission to start and air traffic control granting it.

- High levels of utilisation need optimised planning and operations – the report recommends improving the planning process, building 'headroom' into the schedule, investigating further the causes of ATFM and Start Delays, and enhancing the data collection system.

- Gaining insight from Summer 2017 on-time performance needs a new collaborative approach which adopts formal problem-solving methodologies – further work should adopt a joint iterative analytics approach with access and transparency of the full range of datasets to allow an analytical synthesis of the contributing factors across the 'system'.

Research conclusions

3.54   From the evidence that we have collected – that increased utilisation often leads to increased delay; that consumers currently are aware of acceptable levels of delay but are nervous of any increases; of the incentives and practices of the UK's busiest single runway airport and its airlines not being sufficiently aligned to control delays – it appears that there is a tension between capacity provision and delay. There is less tension between capacity provision and delay at Heathrow, although it is

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[33] The time between an aircraft arriving on the stand and departing on its next flight.
[34] Flights scheduled to depart from Gatwick before 09:00 local time, using an aircraft not previously having departed from or arrived at Gatwick on the same day.

not clear how much this is due to better processes and relationships developed at the airport and how much to the fact that the capacity constraint put in place at the time of the Terminal 5 public inquiry prevents the airport from significantly increasing its declared capacity beyond current levels.

3.55   As demand increases at all the London airports, the tension between provision of more capacity and managing delay will, absent increased efficiency, get worse. It will become more important for industry to be able to manage this well, either through voluntary action or increased regulation. Otherwise, there is a growing risk that consumers will suffer and the incentives in the industry are not currently aligned in such a way as to promote outcomes that are in the consumer interest.

Chapter 4

Capacity Planning and Scheduling

> - **Airports are responsible for declaring capacity (within any planning limits or local authority agreements) and setting delay service levels in cooperation with others.**
> - **There are different levels of process maturity across different airports.**
> - **Airlines are responsible for scheduling assumptions and there are currently no comprehensive checks of appropriateness.**
> - **Once capacity is declared and used, it is difficult to subsequently reduce it if required.**

How an airport declares capacity

4.1   The Worldwide Slot Guidelines (WSG), published by the International Air Transport Association (IATA), provide the global air transport community with a single set of standards for the management of airport slots at coordinated airports and planned operations at facilitated airports.

4.2   The management of airport slots is required at some airports where the available airport infrastructure is insufficient to meet the demand of airlines and other aircraft operators while the management of planned operations at facilitated airports allows a degree of scheduling flexibility within available airport infrastructure capacity.

4.3   IATA describe airports at three levels as summarised below

- **Level 1, non coordinated:** where the capacity is adequate to cater for demand, the airport is responsible for permitting planned operations with airlines.

- **Level 2, facilitated:** at airports where there is potential for peak congestion a facilitator can act in order to mutually agree schedule adjustments to planned operations between airlines.

- **Level 3, fully coordinated:** demand for airport infrastructure significantly exceeds the airport's capacity and attempts to resolve the problem through voluntary schedule adjustments have failed or are ineffective. As a result, a process of slot allocation is required whereby it is necessary for all airlines and other aircraft operators to have a slot allocated by a coordinator in order to arrive or depart at the airport during the periods when slot allocation occurs.

4.4　The system for allocating time slots at airports in Europe, based on pre-existing IATA guidelines, is set out in European Regulation 95/93/EEC ('the EU Slot Allocation Regulation'), as amended by Regulation 894/2002/EC and 793/2004/EC. These were implemented in the UK by the Airport Slot Allocation Regulations 1993 (SI 1993/1067) and came into effect in May 1993.

4.5　In these regulations, a 'slot' is defined as the permission given by a Coordinator to use the full range of airport infrastructure necessary to operate an air service at a coordinated airport, on a specific date and time for the purpose of landing and take-off, as allocated by the Coordinator in accordance with the Council Regulation. This permission is the time that the aircraft arrives at or is pushed back from the terminal stand and should be the same as the time shown on the ticket or itinerary.

4.6　These rules apply to all airports that have been designated as 'fully coordinated' or 'level 3', i.e. those airports where there is insufficient capacity to meet demand. In the UK, Heathrow, Gatwick, Stansted, Luton, London City, Manchester and Birmingham[35] are fully coordinated.

4.7　The EU Slot Allocation Regulations require that the Slot Coordinator is independent of government, airlines and airport management. ACL is the

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[35] Birmingham is the latest airport to become fully coordinated beginning in Summer 2017.

airport coordinator at the UK's major airports[36]; ACL was set up to be an independent, not-for-profit company with an ownership structure made up of the UK´s leading airlines. Current Members are British Airways, Virgin Atlantic Airways, Monarch Airlines, Thomson Airways, Thomas Cook Airlines, Jet 2, Flybe and EasyJet[37], although membership confers no preferential treatment in slot allocation decisions made by the coordinators at ACL. The CAA and Department for Transport have no direct involvement in the slot allocation process at coordinated airports.

4.8   At an airport where slot allocation takes place, the 'competent authorities' are responsible for determining the capacity available for slot allocation twice yearly in cooperation with representatives of air traffic control, customs and immigration authorities and air carriers using the airport and/or their representative organisations and an independent airport coordinator, according to commonly recognised methods. In the UK the competent authority has been delegated to the airport authorities (see Airport Slot Allocation Regulations 1993 (SI 1993/1067))

4.9   The level of slots available at the airport can be influenced by a number of different limiting factors including:

  ▪   Planning conditions or local authority agreements.
  ▪   Runway and terminal configuration.
  ▪   Perceived demand and expected aircraft mix.
  ▪   Level of agreed service levels, including delay or pier service.

4.10   Typically, a coordinated airport determines the number and distribution of slots available through some form of modelling future airport operations. The modelling methods to determine the number of slots at different airports can range from simple to very detailed simulation models. At busy airports the airport authorities generally have commercial arrangements in

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[36] ACL also provides coordination services for airports in Canada, Ireland, Poland, New Zealand, the UAE and Luxembourg.
[37] Other airlines can apply to become members of the governance body also.

place with their air traffic control provider to model increases in slots and resulting levels of runway related delay[38].

4.11   Prior to privatisation, NATS provided all modelling services to airports which required coordination (relatively few) and policy papers on the methodology used were published[39]. Many of these standards seem to have been preserved in the work carried out in later years for privatised airports, although the models have been updated and improved and new ATC providers have been introduced. However, details of the new methodologies have not typically been published.

4.12   For example, during the 1990s the generally accepted planning 'standard' for runway delay had increased from 5mins[40] to 10mins[41] (that is, a level of capacity which produced an average runway delay of no more than this standard on a typical busy day was considered to be acceptable). Since then, the busiest airports in the South East have generally adopted a 10min delay standard. However this is the runway holding time due to congestion and does not cover delays associated with, for example, aircraft pushback and taxiing.

4.13   The EU Slot Allocation Regulations require the formation of a coordination committee at coordinated airports. Membership of the committee is open to the air carriers using the airport in question regularly, the managing body of the airport concerned, the relevant air traffic control authorities and the representatives of general aviation using the airport regularly.

4.14   The role of the coordination committee is, inter alia, to advise the coordinator on matters such as increasing airport capacity, methods for monitoring the use of allocated slots, local guidelines, constraints and rules. The coordination committee can also deal with any complaints on the allocation of slots.

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[38] Runway related delay is ground or airborne holding delay associated with runway congestion. This may not take into account other delays, for example weather or airspace congestion.
[39] For example, CAA Paper 83019 The methodology of runway capacity assessment 1983
[40] CAA Paper 83019 The methodology of runway capacity assessment 1983: "an average delay of 5 minutes over a busy period has been accepted for some years………and is used to assess runway capacity at Heathrow and Gatwick for their scheduling committees."
[41] CAP 627 A guide to runway capacity 1993: refers to a "10 minute delay criteria over a 10 hour busy period"

4.15 Airports also have scheduling committees in order to formulate scheduling policies and guidelines, representing the views of airline operators on scheduling matters, and to promote policies and procedures that balance scheduling flexibility, capacity maximisation and efficient utilisation of facilities with acceptable performance and service quality levels.

4.16 The current process therefore means that the airport and airline users are encouraged to maximise the use of the airport whilst also deciding on levels of punctuality performance that are acceptable, unless there are existing constraints, such as planning conditions limiting the number of movements.

4.17 Often airlines making commercial decisions about capacity need to liaise further with their operational departments and decide to proceed with the slots allocated or return them to the slot pool. If handed back early enough they can be allocated to another airline.

4.18 Once a slot has been allocated to an airline, the EU Slot Allocation Regulations confer 'grandfather rights' on it. This means that, provided the slot is used on at least 80% of the days when it was intended, then the airline is entitled to retain it for the following year.[42]

4.19 The Council Regulation requires all Member States to ensure that effective, proportionate and dissuasive sanctions, or equivalent measures, are available to deal with serious misuse of allocated slots. Sanctions can range from £1000 to £20,000 per event where the misuse is shown to be significant, deliberate and repeated.

4.20 Airlines are expected to operate exactly to their allocated time, however for sanction purposes a certain tolerance is allowed.

4.21 The airline decides how much time to include in its schedule between the origin and destination being served. This may be influenced by a number of factors such as destination, delay history and commercial pressures.

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[42] However, the EU Slot Allocation Regulations make no mention of how to manage a decrease in capacity declaration at a coordinated airport, and if slots should then be removed from airlines that have used them.

4.22   There are currently no comprehensive checks that the airline is able to operate to its allocated time, or is selling tickets at the time it has the slot permission for. However, a CAA analysis of a small sample of airline schedules at different UK airports does not indicate that tickets are advertised at times different to the slot time at present.

History of increases in capacity and utilisation

4.23   Figure 10 illustrates how runway capacity utilisation has changed over recent years at the UK's six fully coordinated airports. Heathrow's utilisation has been static, operating at around 98% of its runway capacity for a number of years. Other London airports have all shown increasing utilisation, with Luton showing the largest increase of 44 percentage points since 2012. Gatwick has increased average annual utilisation from 88% in 2012 to over 100% in 2016[43].

Figure 10: Annual Runway Capacity Utilisation – 2012-2016
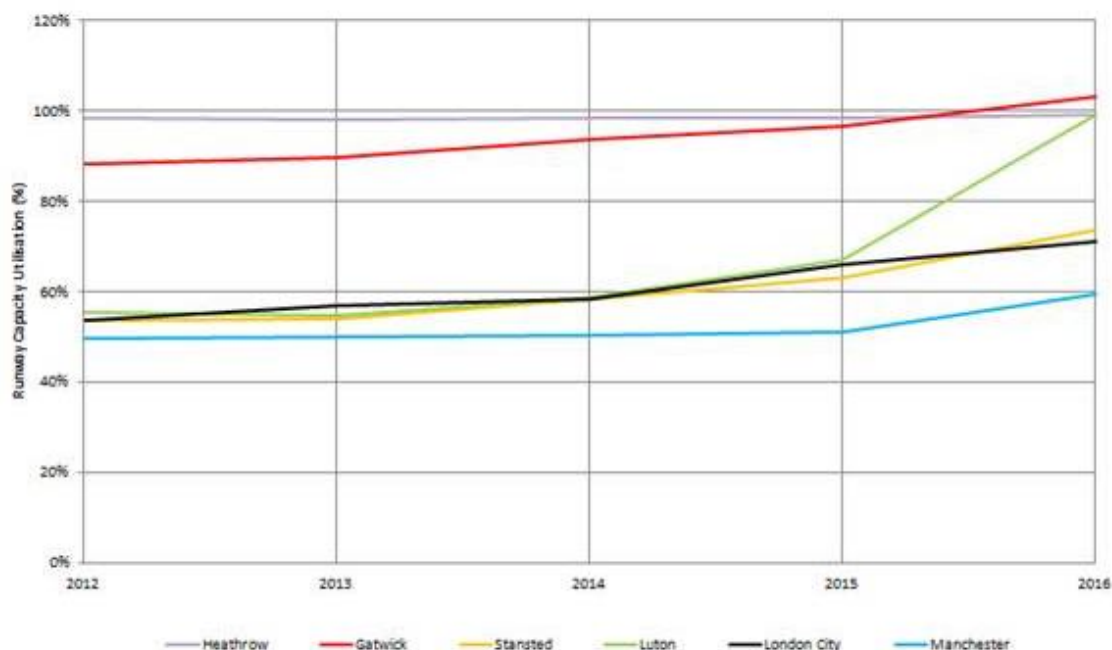
Source: ATM capacity: Airports Commission. Actual ATMs: CAA statistics.

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[43] Airports Commission 2011 base line airport capacity assumptions.

4.24   In the peak summer months, many airports experience even higher
        utilisation; for example Gatwick and Manchester handled over 20% more
        flights in August compared to an 'average' month. During peak periods, on-
        time performance is often significantly lower; for example, in 2015 Gatwick
        achieved 57.2% during August compared to 68.7% for year overall, whilst
        Manchester achieved 70.7% compared to 75.6%.

4.25   London also tops the list of the world's busiest aviation system, in terms of
        passenger numbers, and is in the top three in terms of aircraft movements
        (below New York and Los Angeles). Heathrow and Gatwick also operate
        the most intensively used runways in the world.

Table 4: World's busiest city airport systems 2015

Rank	Metropolitan area	Total passengers (m)	Airport(s) included
1.	London	153.5	Heathrow, Gatwick, Stansted, Luton, City, Southend
2.	New York City	126.7	JFK, Newark, LaGuardia, Stewart, Long Island MacArthur, Westchester
3.	Tokyo	110.1	Haneda, Narita
4.	Atlanta	101.5	Hartsfield–Jackson
5.	Paris	99.8	Charles de Gaulle, Orly, Beauvais
6.	Shanghai	99.2	Pudong, Hongqiao
7.	Chicago	99.2	O'Hare, Midway
8.	Beijing	96.1	Capital, Nanyuan
9.	Los Angeles	95.8	LAX, Long Beach, Bob Hope/Burbank, John Wayne, Ontario
10.	Istanbul	89.4	Atatürk, Sabiha Gökçen

Source: ACI

Industry Incentives

4.26 This summary of broad industry incentives is a combination of our understanding of the industry and discussions with stakeholders highlighted in paragraph 3.14. Clearly, an individual stakeholder will have incentives specific to the circumstances of their competitive offering, brand values and current strategy.

4.27 Airport operators, like all businesses, are incentivised to increase their profits, usually by growing passenger numbers[44] and maximising their revenue. Where runway capacity is scarce, this typically includes maximising its utilisation through encouraging larger aircraft sizes and more flights. Airports also aim to avoid reputational damage from delays, although suffer relatively few direct costs from them[45]. Regulation can introduce price caps and balancing service quality incentives where airports have market power.

4.28 Tower air traffic control providers have a contract with the airport operator and are incentivised to innovate and maximise throughput of the runway whilst maintaining safety.

4.29 Airlines are usually the only bodies to have a direct contract with the passenger. They usually operate in a market with other airlines, competing on price, timetable and service, typically profiting from controlling costs and maximising revenues. They tend to incur direct costs when significant delays occur, both through reductions in aircraft and crew utilisation and passenger compensation costs. They want to maximise utilisation of resources (aircraft, crew and possibly airport slots) and wish to avoid incurring costs due to delays.

4.30 Where runway capacity is constrained, airlines will wish to ensure that they retain valuable slots , since once relinquished, they may be very difficult to re-acquire. In such circumstances, despite the best efforts of slot

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[44] Airports that are subject to economic regulation are typically restricted to a capped level of revenue per passenger, and so are particularly incentivised to increase passenger numbers.
[45] Although there may be staff costs associated with assisting passengers delayed at the airport and arising from different distributions of passengers at, say security, than expected.

coordinators, an airlines' slot timings may not be ideal for maximising utilisation. Sometimes airlines may deliberately not operate to their allocated slot times, although if such behaviour is persistent, it can result in fines from ACL.[46]

4.31   Ground-handling markets at larger airports are generally competitive[47]. The European Commission decided in 1996 that the ground handling market should be regulated in order to increase competition and choice in the supply of ground handling services. It issued a Directive (96/67/EC) which aimed to "reduce the operating costs of airlines and improve the quality of service provided to airport users". So, generally at larger airports, airlines can switch providers if they wish. Ground handlers typically operate on low margins and, since competion between them is usually on cost, are unlikely to be able to afford higher staffing levels to ensure resilience.

4.32   En-route (and London Approach) air traffic control provider NERL is incentivised to provide air traffic services without unduly discriminating particular users.   It is economically regulated by the CAA and has a wide range of targets including efficiency (consistent with EU wide targets) and delay.

Comparison to passenger interest

4.33   As indicated above, industy incentives are generally aligned with the consumer interest, prioritising choice and value which was were the consumer priorities evident from our recent research. However, particularly where capacity is scarce, there is a potential for the pressure to maximise throughput and utilisation to erode consumer benefits through lack of resilience and disproportionate delays.

4.34   For example, at an airport near capacity, delays may be more likely to propagate through the day, and so, as the airport gets bigger, the impact of

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[46] See ACL website for sanction news and reports.
[47] See CAA publication CAP1358 for more information

delays on existing passengers is higher. Thus, decisions to add more slots or lose 'firebreaks' are likely to need more mitigation to maintain a 'positive passenger business case'. Such mitigation may require collective actions between the different industry groups (airlines, airport, air traffic control, etc) which may involve difficult decisions and some parties incurring costs.

4.35   Unilateral actions are less likely to provide net consumer benefits. For example, airlines can increase scheduled flight times to reduce measured delay. However, not only does this come at a cost (in terms of lower aircraft utilisation) which will be passed on to the passenger, but journey times will be no shorter, as the cause of delays has not been addressed.

4.36   We have identified three categories of risk[48] in the planning and scheduling process to the passenger arising from the evidence we have gathered for this study and through our passenger research and request for information. These risks are described below and then possible actions to mitigate them are explored.

4.37   The mitigating actions are shown in a table with a Red/Amber/Green status reflecting our assessment of whether they are practical to explore further[49] and overall in the consumer interest (blue shows initiatives that have already begun) and we set out our rationale for this. The actions fall into three categories:

- Structural – options which require Government or other intervention to change the existing laws or rules around capacity allocation and scheduling.
- Regulatory – the CAA has powers which it could use, for example under its role as economic regulator and its information duty.
- Voluntary / Guidance – rather than compelling different behaviour, it may be preferable to issue best practice or guidance to parties to highlight and encourage outcomes that are in the passenger interest.

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[48] These are risks of increased delay or cost or lack of a service rather than risks to safety or security.
[49] The evidence we have collected, whilst informative, is probably not sufficient in itself to justify the structural or regulatory actions without further investigation or consultation.

Incentive risk

4.38   Resilience mainly comes through the provision of some spare capacity or under-utilisation in the operation[50]. This could be restraint in declaring all the runway capacity that could be used, extra time planned for aircraft turns or flights, or spare resources (aircraft, ground-handlers, etc) available to cover when there are problems. Currently, no single stakeholder is incentivised to bear fully the resilience cost, and many can choose (and at worst may be incentivised) to impose it upon the others.

4.39   For example, the ultimate decision about what airport capacity to declare lies with the airport operator, which is mainly incentivised to increase throughput. In most cases, such decisions are also entirely in the passenger interest. However, should resilience deteriorate markedly, or other stakeholders be forced to reduce utilisation (and so increase costs and prices) to prevent this deterioration, the cost to the passenger may outweigh the benefit of increased capacity.

4.40   Although not bound by their views, the airport operator is obliged to consult with users of the airport before declaring additional capacity. Incumbent airlines that are well established at an airport which is already capacity constrained may prefer to prevent competitors expanding over the opportunity to access new capacity themselves. In such an instance airlines may not be acting in the passengers' interest even though they have the most direct contact with passengers.

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[50] Such 'spare capacity' can also be generated by increasing the efficiency of the operation. This approach is common at airports with capacity constraints.

Incentive Risk – at congested airports there are no collective resilience responsibilities.

No	Incentive Risk	Structural	Regulatory	Voluntary / Guidance
1	Currently, no actor is consistently incentivised to bear the resilience cost, and some can try to impose it on others.		Insert economic licence condition on capacity declaration. OR Information duty.	Encourage industry to consider the how cooperation can increase efficiency and resilience.
2	Airport may expand capacity against passenger interest.	Consider responsibility for oversight and/or decision on capacity declaration in Aviation Strategy development	Change balance of service quality vs passenger volume incentives; Greater reporting of airport service quality metrics.	Produce guidance on either i) how to strike the delay / volume balance in the consumer interest or ii) how airport, users and other stakeholders should share the decision making.
3	Airlines may block capacity against passenger interest.	Consider responsibility for oversight and/or decision on capacity declaration in Aviation Strategy development		Produce guidance on either i) how to strike the delay / volume balance in the consumer interest or ii) how airport, users and other stakeholders should share the decision making.

Only Government has the power to guarantee change in systemic/collective incentive risk. CAA can currently influence LHR, LGW and NERL (and, through NERL, other airports).

Note: Blue shading shows action in progress.

Incentive risk assessment rationale

1) Regulatory: Currently the CAA can only influence Heathrow and Gatwick airports through its economic licence conditions. These airports are close to capacity and the issues they face will be relevant at other London airports, which are not currently subject to economic licensing by the CAA, as demand increases.

   Voluntary: the CAA believes that industry is best placed to consider this and other planning and operational resilience issues in the first instance.

2) Structural: The CAA believes the Government should consider the responsibility for oversight and / or decision on capacity declaration as part of its Aviation Strategy. Any such change may ultimately result in higher costs or lower profits for airports, airlines and consumers. However, it would need to be traded off against improvements in on-time and delay performance as well as the benefits of a fairer process.

   Regulatory: It would be difficult for the CAA to judge what the balance of service quality and passenger volumes should be, and the root causes of delay can make it difficult to apportion 'blame'.

   Voluntary: the CAA could attempt to describe how industry decisions should assess or balance the trade-off between capacity and delay.

3) As in 2) above, except that the CAA has no regulatory powers which could apply to airlines.

Planning and scheduling risk

4.41   The planning process for declaring airport capacity usually begins with the submission of confidential 'wish lists' from airlines to ACL, which are aggregated to give an anonymised view of the demand for slots at the airport. However, at a constrained airport where slots are scarce, airlines who may have little interest in expansion (either for business reasons or because of the perceived resilience effect of extra services on their existing operation) will still prefer to obtain any new slots that may be created than to see them used by competitors. There is a risk that such behaviour will give the false impression that there is a high demand for new slots rather than improved or protected resilience.

4.42   At those airports which undertake sophisticated delay modelling of new capacity scenarios to inform their capacity declaration decisions, there are elements of the actual operation which are not or cannot be modelled. For example, delays arising from external factors such as weather or air traffic control, or the intended turn times of airlines or the availability of ground handlers to cope with the workload. Such modelling may therefore give an unrealistic view of the delays likely to be incurred by a particular schedule, or more significantly the resilience of the schedule to external perturbations.

4.43   It is typical where such modelling is undertaken, that it is the tower air traffic control provider who supplies and runs the simulation model. At one time NATS was the sole provider of tower ATC at the main airports and so the modelling would likely be done on a consistent basis. However, now that the tower air navigation services market is liberalised, there may be other models used. Indeed, for smaller airports much less sophisticated modelling may be used now, but as they become more congested, they will need to imporve this aspect of their planning. Therefore there is a risk that there is no oversight, standards or even best practice in place for modelling delay and capacity.

4.44   The process of allocating increased slot capacity is well defined in the EU Slot regulations and documentation produced by ACL. However, much

less well defined is the process for decreasing slot capacity. Where capacity is decreased because slots have been left unused, or it has been agreed to re-time them, then they can be removed easily from the schedule. However, if capacity needs to be reduced to counteract resilience issues (which may have arisen either because of previous capacity increases or because of changes to external factors), then there is no established process. Each airline using a slot will believe[51] it has 'grandfather rights' to use it again in the coming season.

4.45   Even where individual airports make capacity declaration decisions in line with the interest of their passengers (as is certainly the case the majority of the time), such decisions are currently taken in isolation of the decisions at nearby airports. In areas where nearby airports share the same airspace and that airspace may itself be the capacity constrained, as is increasingly the case over London for example, then there is a risk to the passenger that the overall impact of capacity decisions on delays is not appreciated by any of the decision makers. In this environment, collective planning and action needs to be considered.

4.46   In a similar fashion, airline decisions on block times, taxi times and turn times, or on aircraft utilisation are also not subject to any scrutiny or standards, even though they may have a significant effect on whether the modelled delay accurately reflects the likely reality, potentially to the detriment of passengers and other airlines at the airport.

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[51] Possibly quite rightly. To the CAA's knowledge, an airline's grandfather rights to slots in the face of reduced overall capacity at a fully coordinated airport has never been tested legally.

Planning & Scheduling Risk – Current methodology for estimating demand and delay leads to inefficient outcomes.

No	Planning & Scheduling Risk	Structural	Regulatory	Voluntary / Guidance
4	Airlines that would rather see no expansion, bid for any new slots that may be created.	Consider responsibility for oversight and/or decision on capacity declaration in Aviation Strategy development	Use economic licence to influence how capacity should be modelled and capacity decisions made.	Encourage industry to consider the how cooperation can increase efficiency and resilience.
5	Delay modelling of new capacity scenarios focuses on days with no external delays, takes no account of airline scheduling, etc.			
6	No oversight or standards for modelling delay and capacity exist.			
7	Slots, once created and used, are difficult to take back, even if in the interest of customers and airlines.	Consider amending the UK slot legislation to define how slots are reduced if required.	Use economic licence to force airports to reduce slots.	Produce guidance on how the airport and airlines could reduce slots (for example with communally funded compensation) if necessary.
8	Demand and capacity decisions are made locally at individual airports, and their aggregate effect on London or UK airspace is not taken into account.	Amend the UK slot legislation to mandate sharing of schedules with NATS.	Use NERL licence to require oversight of capacity declaration.	NATS to review likely pinch-points and advise industry on likely remedies.
9	Airline decisions on block times, taxi times, turn times, etc are not subject to oversight.		Use of information duty to highlight instances of poor planning.	Encourage a cross-industry group to consider the how cooperation can increase efficiency and resilience.

Only Government has the power to guarantee change in systemic/collective planning risk. CAA can currently influence LHR, LGW and NERL (and through NERL other airports).

Note: Blue shading shows action in progress.

Planning and Scheduling risk assessment rationale

4)   5)   6) Structural: The CAA believes the Government should consider the responsibility for oversight and / or decision on capacity declaration as part of its Aviation Strategy.
Regulatory: Currently the CAA can only influence Heathrow and Gatwick airports through licence conditions.
Voluntary: the CAA believes that industry is best placed to consider this and other planning and operational resilience issues in the first instance

7) Structural/Voluntary: There is an opportunity for the Government in its review of Aviation Strategy to consider clearly defining the process which should be used if a reduction in slots were required. The CAA believes this is better done through the slot regulation, since guidelines would not give any more certainty than currently.
Regulatory: Currently the CAA can only influence Heathrow and Gatwick through licence conditions.

8) Voluntary: NATS have recently started to collect schedules in the London area to improve planning and decision making. The CAA will monitor progress and therefore does not believe licence conditions changes or legislation is required.

9) Regulatory: In terms of airline scheduling, using our information duty is unlikely to have the desired improvement effects.
Voluntary: the CAA believes that industry is best placed to consider this and other planning and operational resilience issues in the first instance.

Airspace risk

4.47   Throughout Europe there is a move to simplify and harmonise the way airspace and air traffic control is used through the Single European Sky project. In the UK and Ireland, this is being met through the UK's Future Airspace Strategy which sets out a plan to modernise airspace by 2030 and is being taken forward by the UK industry.

4.48   However, the CAA set out in its April 2017 evidence to the Transport Select Committee[52] what it believed was required for progress to be made with airspace modernisation in the interests of passengers. These included greater transparency and community engagement as well as a coherent masterplan for airspace design and enforcement.

4.49   The government has consulted on national airspace policy in 2017, whilst the CAA has consulted on reforming how it makes decisions about the design of UK airspace. Improvements to evidence and transparency will help us reach decisions that balance the interests of all stakeholders, including communities around airports, consumers and others who use UK airspace.

4.50   The last couple of years have seen an increase in the incidence of air traffic control strikes and other disruption in the rest of Europe which has increased delays for flights in and out of the UK. Although modernisation of European ATC under the Single European Skies initiative is likely to increase the resilience of air travel in the long term, in the shorter term, whilst it is being implemented and demand for air transport increases, there is a risk that such delays will become more prevalent.

4.51   En route air traffic control and the London TMA are managed by NATS whose licence requires it to meet any reasonable level of overall demand for ATC services without unduly discriminating against any user or type of user after taking into account the need to maintain the most expeditious flow of air traffic as a whole. However, as demand for airspace increases, it may become harder for NATS to plan to meet the requirements of all

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[52] www.caa.co.uk/CAP1532

users and it will need to develop strategies for coping in line with its licence. Since this sort of 'airspace rationing' is so far untested anywhere in the world, there is a risk that such strategies may not initially be the most efficient for consumer.

4.52   Commercial aviation tends to fly to predermined schedules, and so the likely volumes of traffic are possible to plan for in advance. General Avaition (including Business Aviation) is much more likely to operate on an ad hoc basis and so is more difficult to plan for in terms of managing airspace. This makes it harder (for ATC or other decision makers) to optimally balance the needs of consumers of commercial and general aviation services.

Airspace Risk – UK and European airspace does not provide the most efficient service for passengers.

No	Airspace Risk	Structural	Regulatory	Voluntary / Guidance
10	UK airspace requires modernisation, but progress may be hindered by the need for greater transparency and community engagement and by the absence of a coherent masterplan for airspace design and enforcement.		Review of ACP to make the process more transparent.	
11			Explore the use of NERL licence conditions/ incentives to include airspace change proposals	
12	Disruption in Europe due to modernisation – strikes, service levels. disrupted through training, etc.	European legislation to allow neighbouring ATC to step in to improve service levels.		Better sharing of information and alternative options between NATS, Airports and Airlines.
13	Unclear how ATC prioritises traffic when delays occur – is it most efficient for consumer?	Changes to aviation legislation to clarify.	Explore NERL licence condition to explicitly indicate how traffic should be prioritised.	Letter of reassurance to NATS on CAA understanding of existing licence condition; review of how NATS use this interpretation.
14	Difficult to plan for GA, whose flights therefore have greater potential to adversely affect the system.	Expand level 3 slot regime to all airports in London TMA.	Explore NERL licence condition to explicitly indicate how traffic should be prioritised.	Letter of reassurance to NATS on CAA understanding of existing licence condition; review of how NATS use this interpretation.

Government and CAA in tandem have the power to change systemic airspace risk.

Note: Blue shading shows action in progress.

Airspace risk assessment rationale

10) Regulatory: The Government has consulted on national airspace policy in 2017. The CAA has consulted on reforming how it makes decisions about the design of UK airspace. Improvements to evidence and transparency will help us reach decisions that balance the interests of all stakeholders, including communities around airports, consumers and others who use UK airspace.

11) 13) 14) Regulatory: The CAA will consider the timing of airspace change proposals in NERL's licence review in for the period 2020-2024, in particular whether any commitments or incentives can be introduced.

12) Structural; In terms of disruption in European airspace, changing EU legislation is likely to take time, and given the UK's current position regarding Brexit it is unclear what influencing role we may have in European aviation matters. Voluntary: The CAA believes airports should continue to work with the Network manager and discuss mitigation plans in advance with airlines in order to strike the best balance for the airport operation between delays, costs and cancellations.

13) 14) Guidelines: The CAA recently wrote to NATS on the subject of prioritisation and recommends that this is considered further in the next NERL licence review if it can bring further improvements. There would be no need to change legislation in this case which would also be less flexible.

14) Structural: In terms of planning for GA traffic it would be difficult to expand all airports in London to level 3 coordinated as this would require change to European Slot regulations and would be inconsistent with IATA guidelines.

Chapter 5

Operational consistency

> - **The operational plan can be affected by controllable and uncontrollable factors.**
> - **Controllable factors can include operational behaviours, targets, resourcing levels or physical infrastructure.**
> - **These factors need to be consistent with the plan, particularly at busy airports where delays can be difficult to recover.**
> - **Consumers value information when they are experiencing delays.**

5.1   Once the planning and scheduling process has concluded, the operational plan (whether realistic or not) can be influenced by factors and behaviours on the day. These have the potential to introduce variability and exacerbate delays.

Operational risk

5.1   Some of the issues identified by stakeholders (excluding uncontrollable events such as weather) include:

- First wave departures fail to leave on time, creating problems for the remainder of the day.
- Aircraft arrive at top of stack or airport outside their expected times.
- Use of push and hold and/or towing to free up stands, even though aircraft must wait to depart.
- ATC resourcing does not allow sufficient resilience to sickness, etc.
- Ground-handling resourcing is not sufficient to recover when delays start to occur. Airline dispersed stand allocation causes delays for ground handlers.
- There are no constraints on slot destination, so some SIDs or STARs may become overloaded.
- Airlines don't pass information on regarding PRMs causing delays

Options to address risks to consumers

5.2 Below we have illustrated these risks in the following categories and set out a number of possible options for addressing them:

- Operational risk
- Information risk

Operational Risk – Operational behaviours are not consistent with the plan and therefore propogate delays.

No	Operational Risk	Structural	Regulatory	Voluntary / Guidance
15	First wave departures fail to leave on time, creating problems for the remainder of the day.		Allow airport to amend charges based on adherence to schedule OR publish service data.	Encourage industry to consider how better operations can increase efficiency and resilience.
16	Aircraft arrive at top of stack or airport outside their expected times.	ACL sanctions for slot abuse.	Require NERL to favour those aircraft that are on time.	Produce best practice guidance and recommend metrics to monitor compliance.
17	Use of push and hold and/or towing to free up stands, even though aircraft must wait to depart.		Include standards explicitly in licence conditions.	Encourage industry to consider how better operations can increase efficiency and resilience.
18	ATC resourcing does not allow sufficient resilience to sickness, etc.		Consider staffing levels in a general resilience licence condition.	
19	Ground-handling resourcing is not sufficient to recover when delays start to occur.		Consider how resilience can be improved by reviewing the CAA's role under the Ground Handling Regulations.	Encourage industry to consider how better operations can increase efficiency and resilience.
20	There are no constraints on slot destination, overloading SIDS/STARS	Amend UK slot legislation to introduce limits on SID / STAR use.		Encourage a cross-industry group to consider how better operations can increase efficiency and resilience.
21	PRMs are not notified, causing delays.			CAA could publish lists of airlines who do not notify airport of PRM on board.

CAA only has powers to guarantee change in individual operational risk covering NERL and currently LHR and LGW.

Note: Blue shading shows action in progress.

Operational risk assessment rationale

15) 17) 20) Voluntary: the CAA believes that industry is best placed to consider this and other planning and operational resilience issues in the first instance.

16) Structural: At present there are sanctions by ACL for airlines that deliberately and repeatedly abuse their slot times. Regulatory: The CAA believes it would currently be difficult for NERL to favour aircraft that are on time, due to airspace and holding operations. This would introduce further complexity and workload in an already congested system. There are likely to be opportunities in the future as and when point merging is introduced.

18) Regulatory: There is an opportunity for building in resilience into NERL's licence, however many efficiency targets are currently influenced by consistent European wide legislation.

19) Regulatory: In terms of ground handling performance the CAA is currently considering responses to its request for information[53], in which it considered ground handling to be a key determinant to a reliable and resilient operation.

20) Slot regulations allow flexibility in destination for a particular slot. This is important for airlines but can also overload SIDS and STARS causing delay. The CAA believes that industry is best placed to consider this and other planning and operational resilience issues in the first instance.

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[53] CAP1409 Access to the ground handling market at UK airports: a review of the CAA's approach

21) Voluntary: The CAA intends to review its information duties and punctuality statistics in 2017 and there may be an opportunity to incorporate additional metrics in order to encourage better performance.

Information risk

5.1   There is the potential for consumers to be misinformed at the point of sale, as there are no comprehensive checks to ensure that tickets times correspond with the allocated airline slot. However, a CAA analysis of a small sample of airline schedules at different UK airports does not indicate that tickets are advertised at times different to the slot time at present.

5.2   Our consumer survey suggested that delay information at the point of booking was not a priority in the booking process, but value information when they are experiencing delays.

Information Risk – Consumer information could be lacking or misleading

No	Information Risk	Structural	Regulatory	Voluntary / Guidance
22	Consumers misinformed at point of sale.	Sanctions for selling off-slot schedules.	Use Info duty to publish e.g. slot vs schedule times or flight vs taxi times Collect and publish more data on service to PRMs using info duties.	CAA could publish information on e.g. slot vs schedule times or flight vs taxi times. Greater use of airline OTP league tables.
23	When disruption occurs consumers desire more information, however airlines may be worried about triggering EC261 delay claims.			Airlines and airports to review/improve process for collecting and communicating delay causes as they happen.

CAA has an influencing role by publishing information or introducing licence conditions at LHR and LGW.

Information risk assessment rationale

22) There is a risk that consumers are misinformed at the point of sale, however a CAA analysis suggests that there is not a problem at present. It would therefore be a disproportionate response to propose actions in this area.

23) Consumers suggested to us that they would like better information when disruption occurs. For the CAA to intervene there would need to be a breach of consumer law, and therefore airlines and airports should consider areas for improvement

Chapter 6

Conclusions

- **There are currently no collective rights and responsibilities potentially leading to inefficient outcomes.**
- **There are broadly three options for change: Voluntary, Regulatory and Structural reform.**
- **Given the expertise available to it, we believe that the Voluntary Industry Resilience Group's recommendations should provide a good starting point for agreed industry measures or the Aviation Strategy.**
- **There are still opportunities to consider or formalise resilience issues through the appropriate airport and NERL licence process.**
- **The CAA believes that the Government should consider options reform as it develops it's Aviation Strategy.**

The current situation

6.1   The UK, in particular the South East, has experienced high levels of aviation growth in recent years, At the same time there has been a decline in on-time performance, which is more pronounced during summer peak months when utilisation is even higher.

6.2   Existing airport and airspace infrastructure will be under increasing demands in the future. In 2016, NATS were predicting[54] a further 9% increase in aircraft movements at the five major London airports by 2022. Moreover, once runway capacity is declared and allocated, it may be difficult to prevent its future use.

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[54] http://nats.aero/blog/2016/02/record-demand-will-put-pressure-on-airspace-capacity10605/

6.3   There is no prospect of significant capacity increases before 2025, and therefore therefore it is important to consider if and how these issues can be addressed before passengers begin to suffer disproportionately.

6.4   Whilst industry incentives are generally aligned with the consumer interest, there are currently no collective rights and responsibilities concerning resilience, potentially leading to ineffecent outcomes for consumers. This is different to other industries where for example a business can invest and guarantee higher service levels in return. In the aviation industry there are many complexities, so that it may be difficult for a single entity to guarantee improvements and where improvements are realised, they may well benefit competitors as well as the business making the investment.

Options for change

6.5   The CAA believes that, in the period up to and following the provision of new runway capacity in the South East, action needs to be taken to mitigate the risks to consumers arising from lack of resilience which we have highlighted in this report.

6.6   Given that the problems we have identified are likely to require collective cross industry action to resolve, we believe identification of solutions to aviation's resilience issues is best left in the first instance to industry. Therefore in early 2017, the CAA decided to test industry appetite for forming a voluntary group to consider how best to tackle these issues. In April 2017 a group of airports and airlines based in the congested South East of the UK, along with NATS, ACL and the CAA formed the Voluntary Industry Resilience Group (VIRG) to pool their expertise and recommend actions (for industry itself or the Government, as part of its expected review of Aviation Strategy) to address current and future resilience issues.

6.7   Its objective is to improve in a systemised manner the way in which the UK's aviation network is planned and operated to enhance its day to day operating resilience, reduce delays and the associated costs to both industry and passengers.

6.8   The VIRG does not have powers to implement measures, but will make
        recommendations to Government (potentially including proposals for
        changes to legislation), the regulator, the slot coordinator, air traffic service
        providers, airports, airlines or others as appropriate. In particular, its
        recommendations should be a key input into the Government's expected
        review of Aviation Strategy.

6.9   Notwithstanding the recommendations of the VIRG, there are still
        opportunities for the CAA to consider or formalise resilience issues through
        the appropriate airport economic licence process. However, CAA
        regulation may not be the most appropriate mechanism, as for airports it
        only applies currently at Heathrow and Gatwick, and we can only introduce
        licence conditions at airports where we have deemed that they have
        sufficient market power to require a licence.

6.10   The CAA could also consider NERL licence conditions to cover traffic
        prioritisation, airspace change, airport schedule oversight and staffing level
        resilience. Any such changes must be implemented through the
        appropriate licence process involving consultation with NERL and its
        stakeholders, and must be considered in the context of relevant European
        wide airspace targets.

6.11   Government intervention would take time and there is an opportunity as a
        likely new aviation strategy and legal arrangements for a new runway are
        developed. The CAA believes that the Government should consider
        options for structural reform as it develops its aviation strategy. In
        particular what beneficial changes (if any) could be made to the airport
        capacity declaration responsibilities (or oversight) or to the UK slot
        legislation, and the potential benefits of a network system manager who
        could plan, co-ordinate and make decisions to improve resilience.

6.12   The CAA also intends to review its punctuality statistics reporting during
        2017 and could take the opportunity to introduce new or modified
        measures that better capture resilience or the factors which affect it.

Appendix A

Request for Information responses

List of respondents

Member of the commercial aviation industry (13)

Airports (4)

- Gatwick Airport
- Heathrow Airport
- London Luton Airport
- One airport who preferred not to be identified

Airlines (5)

- British Airways
- Monarch Airlines
- Three airlines who preferred not to be identified

Consultancies (1)

- Astute Aviation

Other (3)

- Gatwick Airport Consultative Committee (ACC)
- London (Heathrow) Airline Consultative Committee (LACC)
- NATS

Member of the General Aviation community (2)

- Two individuals

Resident affected by aviation (4)

- Gatwick Obviously Not
- Three individuals

Government and / or other regulators* (1)

- Airport Coordination Ltd (ACL)

Elected political representative (0)

National representative organisation or institute (2)

- Airport Operators Association (AOA)
- Association of British Travel Agents (ABTA)

Military (0)

Airline passenger (1)

- One individual

Quantitative analysis of multiple choice questions

Of the 23 responses, 12 were submitted via the online form and therefore not all questions were answered. The analysis below illustrates the 12 that were submitted online.

Q1 - Do those that plan the use of aviation infrastructure (Airports, Airlines, Air Traffic Control, and ACL) understand consumer interests when balancing capacity and resilience decisions? Yes (5) no (6) not answered (1).
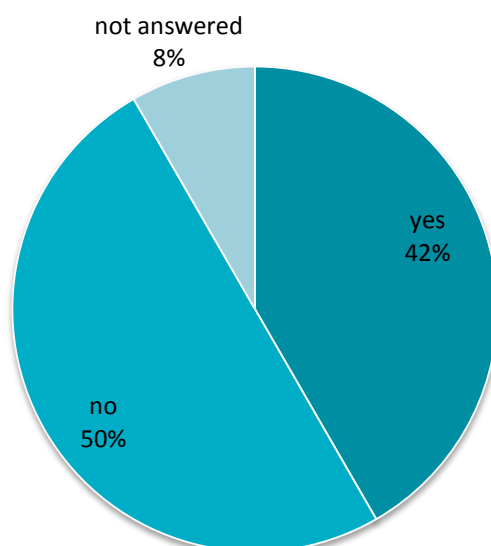
Q5 - Who is responsible for making airport capacity declaration and scheduling decisions? Airport operator (5) airline demand (3) collaboration (4).
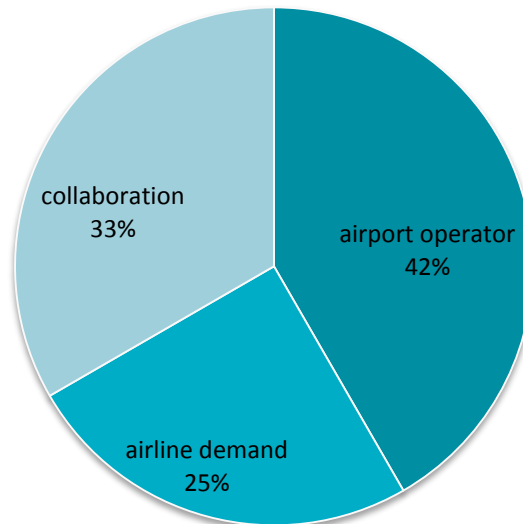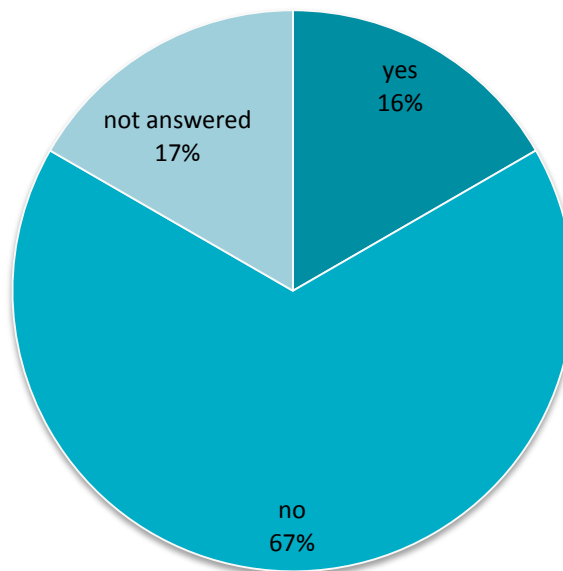

Q6 - Do the mechanics of decision making work well? Yes (6) no (4) not answered (2).
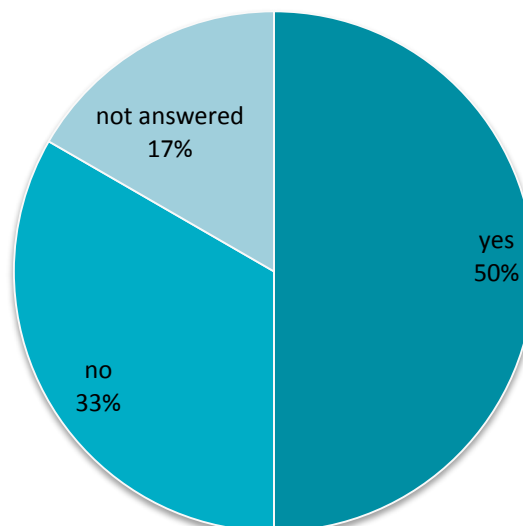
Q10 - Should the underlying rationale for these decisions be made public Yes (6) no (2) not answered (4).
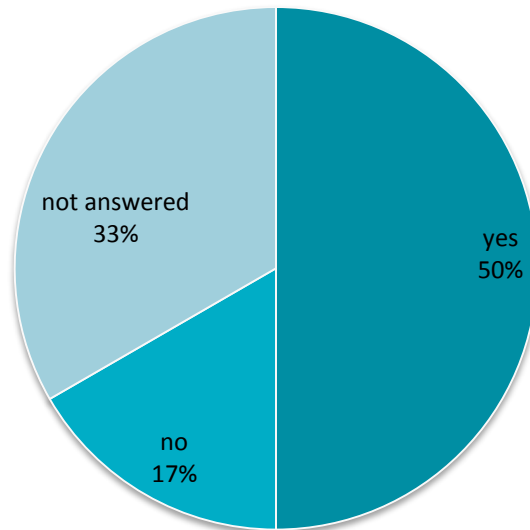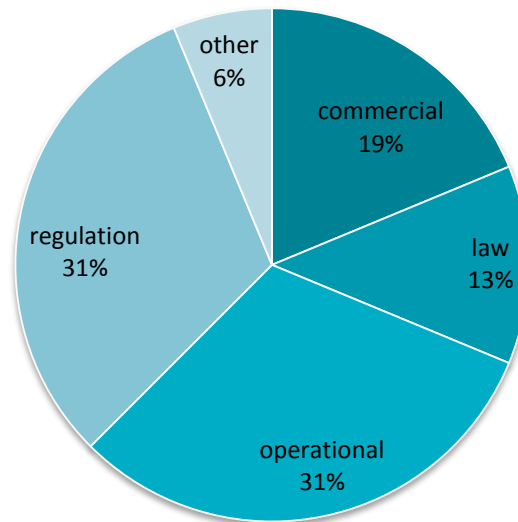

Q11 - Are wider impacts considered e.g. the impact of one airport's decisions and interactions with others in the system? Yes (2) no (8) not answered (2).
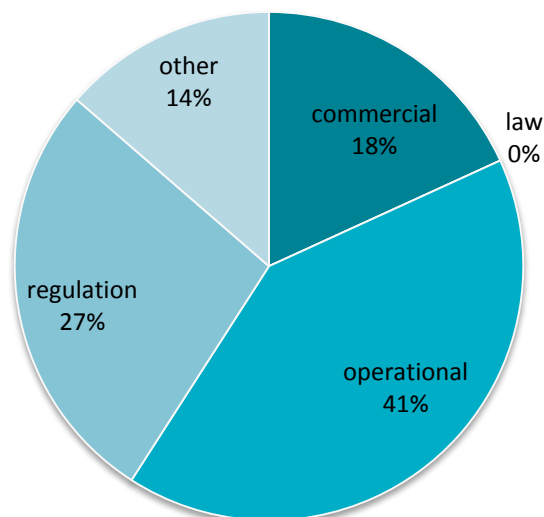
Q14 - What aspects of the current regime (e.g. law, regulation, operational, commercial, other) may lead to sub-optimal decisions being made? Commercial (3) law (2) operational (5) regulation (5) other (1).
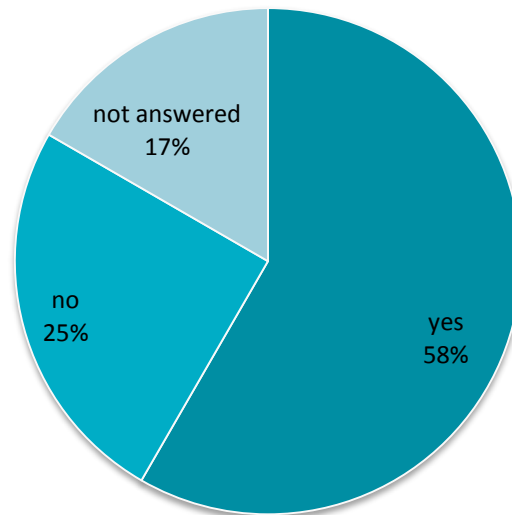

Q15 - What are the major challenges facing operational performance now and over the next 10 years? Commercial (4) law (0) operational (9) regulation (6) other (3).

Q18 - Are there any lessons to be learned elsewhere that could be applied in the UK? Yes (7) no (3) not answered (2).

Q19 - How well do parties share relevant operational information at present? Very well (4) quite well (2) not well (2) no opinion (1) other (1) not answered (2).
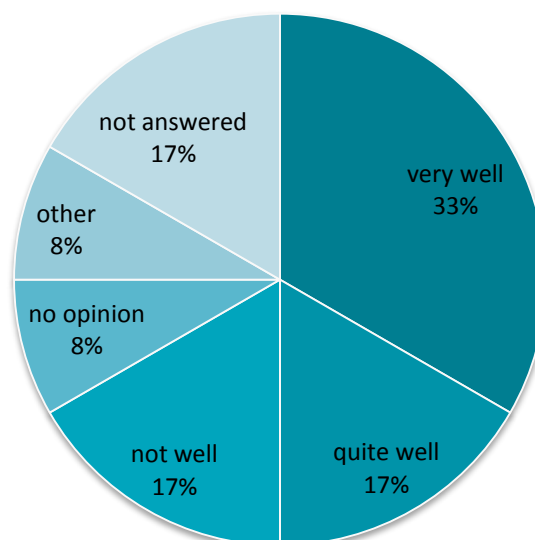
Q20 - Is all the information relevant to improve network performance (not just at individual airport level) shared effectively? Yes (3) no (7) not answered (2).

not answered
17%

yes
25%

no
58%
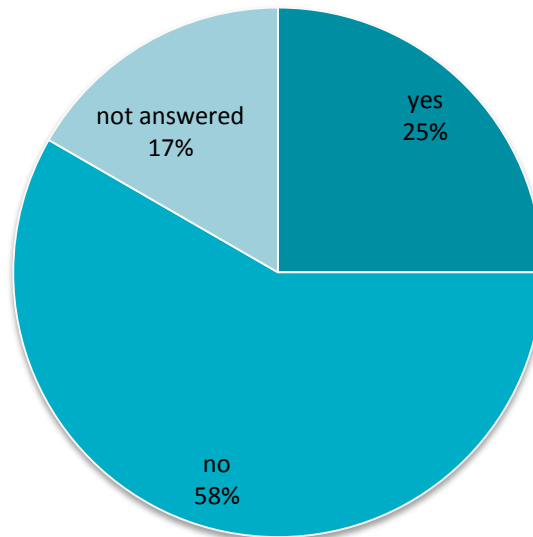
Appendix B

Glossary

Although we have avoided the use of abbreviations where possible in this and our earlier consultation document, in the interests of completeness we have included below some common abbreviations – as well as other terms – that relate to airspace change.

Abbreviation or term	Description
A-CDM	Airport Collaborative Decision Making – a tool that aims to improve the operational efficiency of all airport operators by reducing delays, increasing the predictability of events during the progress of a flight and optimising the utilisation of resources. This aim is to be achieved via improved real time information sharing between airport operators, aircraft operators, ground handlers and air traffic control.
ANSP	Air navigation service provider – an organisation which operates the technical system, infrastructure, procedures and rules of an air navigation service system, which may include air traffic control. (In this document, for ease of comprehension we generally use the term air traffic control provider.)
ASMA	Arrival Sequencing Metering Area - This purpose of the ASMA additional time indicator is to provide an approximate measure of the Average inbound queuing time on the inbound traffic flow, during times that the airport is congested.
ATC	Air traffic control.
ATFM	Air Traffic Flow Management - is the regulation of air traffic in order to avoid exceeding airport or air traffic control capacity in handling traffic, and to ensure that available capacity is used efficiently.
ATM	Air traffic management – the combined processes of air traffic control, air traffic flow management, and aeronautical information services. ATM can also mean air transport movement.

Abbreviation or term	Description
FAS	Future Airspace Strategy – a collaborative initiative between a range of stakeholders for modernising the UK's airspace (which sets the direction, but does not include details or recommendations about specific structures or flight paths). www.caa.co.uk/fas.
General Aviation (GA)	Essentially all civil flying other than commercial airline operations, which therefore encompasses a wide range of aviation activity from powered parachutes, gliding and ballooning to corporate business jets, and includes all sport and recreational flying.
ICAO	International Civil Aviation Organization – the agency of the United Nations responsible for international standards for civil aviation.
IFR, VFR, SVFR	Flight Rules – aircraft can operate under Visual Flight Rules or Instrument Flight Rules. There is also an intermediate form, Special Visual Flight Rules.
NATS, NERL, NSL	NATS (formerly National Air Traffic Services), the biggest air navigation service provider in the UK, parent company of NERL (NATS En Route plc) and NSL (NATS Services Limited). www.nats.co.uk
Point Merging	Point Merge is a systemised method for sequencing arrival flows.
SES	Single European Sky, European legislation that supports a programme of modernisation and harmonisation of airspace structures and air traffic control methods for a more systemised and efficient European air traffic management system.
SESAR	The Single European Sky Air Traffic Management Research (SESAR) project, which concerns the roll-out new technology across the European Union.
TBS	Time Based Separation - A relatively new system to separate arriving aircraft by time (Time Based Separation or 'TBS') instead of distance (Distance Based Separation or 'DBS') to improve arrival flows and cut delays in strong headwinds.
TMA	Terminal Manoeuvring Area – a designated area of controlled airspace surrounding a major airport where there is a high volume of traffic.