Alternative allocation mechanisms for slots created by new airport capacity

Final report by DotEcon Ltd.

6 September 2006
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1 Summary

1. This report considers alternative allocation mechanisms for the allocation of significant amounts of new airport capacity at congested airports. We wish to identify which methods of allocation might potentially be feasible and what the associated costs and benefits might be.

2. Methods for the primary allocation of new capacity are important as the UK Government supports the development of two new runways at congested airports in the South East of England within the next 30 years. At the same time, Government has also clearly stated that it wishes to see scarce airport resources used efficiently and that it believes this would be more likely if market based allocation mechanisms were used.

3. This study has included an extensive dialogue with industry stakeholders in order to understand the feasibility of various alternative allocation methods.

1.1 Role of the secondary market

4. As specified in our terms of reference, we assume throughout this report that there is a functioning secondary market in airport slots. We assess the effects of using different methods of primary allocation against a background where secondary trading is possible.

5. The EU Slot Regulations\(^1\) (the Slot Regulations) currently in force allow airlines to swap slots. However, in the UK, case precedent has established a defacto secondary market in airport slots at London Heathrow and London Gatwick. It is hoped that proposed revisions to the Slot Regulations to be announced in the near future will formalise secondary trading of slots. To the extent that there is uncertainty surrounding the legality of secondary trading under the current regime, formalising secondary trading within a revised set of Slot Regulations should improve the functioning of the secondary market.

6. Secondary trading allows slots to flow from users with less valuable uses to those with more valuable uses. This can improve the efficiency with which slots are used where:

   • the initial allocation of slots was not fully efficient; or

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• changes in airlines’ circumstances over time generate a need for adjustments of the initial allocation of slots.

7. Provided that there is effective competition amongst airlines, slots flowing to airlines with greater willingness to pay for them will ultimately benefit consumers. Airlines whose services offer greater benefit to customers or who can reap operating efficiencies will to tend to win slots. Barriers to competition may be reduced, as both new entrants and successful airlines wishing to expand can acquire slots where they can use them more profitably than existing users.

1.2 Why primary allocation matters

8. Although secondary trading should substantially improve the efficiency with which slots are used, it is still important to ensure that new capacity is initially allocated as efficiently as possible. This is because not all the secondary trades that could lead to efficiency improvements will actually take place. Even after any reform of the Slot Regulation, slot transactions are likely to occur through occasional bilateral bargains, which may fail to complete for various reasons. Therefore, we should not rely entirely on the secondary market to remedy any failures in how new capacity is initially allocated.

9. An administrative process for allocating new capacity cannot effectively take account of the different airlines’ relative willingness to pay for slots. Therefore, administrative allocation of slots will typically not be particularly efficient, as when capacity is scarce there is no guarantee that slots are awarded to the airlines that value them most. This is an inherent limitation of administrative allocation methods. Secondary trading may remedy some, but not all, of these inefficiencies.

10. In contrast, market based primary allocation creates competition amongst airlines for slots and does take account of relative willingness to pay. This can typically be expected to result in a more efficient initial allocation of new capacity. However, the extent of any gain in efficiency will depend not only on how inefficient an administrative allocation process for new capacity is relative to using market based allocation, but also what impediments there might be to secondary trading.

11. It is difficult to estimate the size of efficiency gains from using a market based allocation mechanism compared with an administrative mechanism, as this depends on how effective the secondary market is. We use a stylised model to examine this question, making generally optimistic assumptions about the likely efficiency of administrative allocation. We find that there could be an efficiency loss in the range of 7% to 16% due to the secondary market not fully being able to rectify inefficiencies remaining after a typical administrative primary allocation. Although the secondary market is effective in making best use of slots, there are also significant benefits to ensuring primary allocation is as efficient as possible.
12. Furthermore, if the secondary market is used as a means to iron out inefficiencies created by primary allocation of slots, airlines who had received slots in the primary allocation may benefit from substantial windfall gains. Windfall gains are not necessarily a problem for efficiency of slot use, but may nevertheless be undesirable as:

- potential windfall gains produce an incentive for speculative applications, which could further burden an administrative system and challenge its ability to allocate slots in a sensible manner in the first instance;
- the scarcity rent related to new capacity at a congested airport is transferred to speculators and so is not available to fund capacity increases or compensate those affected by environmental externalities.

1.3 Secondary trading is necessary

13. Secondary trading will continue to play an important role even if market based primary allocation mechanisms are introduced. This is because demand for slots changes over time and the secondary market allows slots to change owners as circumstances change. For example, one airline may go bankrupt while another is growing profitably. This phenomenon is observable in the trading activity at London Heathrow, where a greater proportion of slots changed hands in the seasons immediately following the shock to the aviation industry created by 9/11 than in more typical years.

14. Secondary trading and market based primary allocation mechanisms complement each other. One does not replace the need for the other. Therefore, there is a strong argument for revised Slot Regulations to strengthen the role of secondary trading regardless of the approach taken to primary allocation. Similarly, there are benefits from more efficient primary allocation even if secondary trading is possible.

1.4 Dropping the new entrant rule

15. There are good reasons to believe that the current Slot Regulations may hinder the efficient allocation of scarce airport capacity. Regardless of whether administrative or market based primary allocation is used, there is a case that the new entrant rule would frustrate an efficient allocation of significant new capacity and lead to excessively fragmented outcomes. At present, only airlines with no or limited presence at a congested airport would qualify as new entrants. The new entrant rule hinders rather than helps smaller and medium-sized airlines wishing to expand to compete head-to-head with larger airlines in terms of frequency and density of interconnecting routes. Therefore, rather than promoting competition, the new entrant rule is likely to weaken it by creating barriers to expansion for smaller and medium sized airlines. This is ultimately to the detriment of consumers.
16. There was strong support from the large majority of stakeholders for the proposition that the new entrant rule would lead to fragmented outcomes and frustrate rather than foster competition.

17. Any reduction in new capacity reserved for new entrants would clearly reduce the scope of this problem. However, we can see no compelling case for retaining any reservation for new entrants given that this leads to a restriction on the supply of slots to expanding airlines.

18. The alternative approach of relaxing the definition of a new entrant is unsatisfactory. This would modify but not eliminate the problem, as competition would still be impeded due to expansion barriers on smaller airlines once they had expanded to the point that they failed the new entrant test. In addition, there would still be incentives for speculative acquisition of slots reserved under any form of new entrant rule. This might possibly require restrictions on secondary trade (as under the current Slot Regulation) that could frustrate efficient use of slots.

1.5 Existing inefficiencies in primary allocation

19. Looking at how pool slots are allocated under the current system, we observe various behaviours that are consistent with primary allocation being inefficient. In addition, there are a number of strong *a priori* arguments to suggest that primary allocation is unlikely to be efficient, as there is no way for the coordinator to take into account the economic value that airlines might generate from slots. This is a fundamental limitation of administrative allocation methods.

20. Under the current Slot Regulation, the Government is limited in what it could do to promote a more efficient allocation of new capacity at congested airports. It is not possible to use market mechanisms for primary allocation. Wholesale reform of administrative allocation procedures is not possible, as the criteria for allocation are specified in the Slot Regulations. Without revision of the Slot Regulation, at best minor changes of existing administrative allocation methods might be possible through local rules.

1.6 The range of feasible alternatives

21. With appropriate revision of the Slot Regulation, there are numerous conceivable approaches that could be taken to primary allocation of new capacity. We developed a wide range of proposals to present to stakeholders in order to test the feasibility of various approaches. These included:

- development of the current administrative allocation system through refinement of the allocation objectives;
- extension of the administrative allocation system to consider the relative desirability of different uses for slots (a so-called “beauty contest”);
• administratively set prices for slots to reduce excess demand;
• a simple ‘clock auction’ preceding the current detailed administrative allocation as an initial stage and so forming a two-stage hybrid process; and
• a more complex combinatorial auction process entirely replacing the current administrative allocation system.

22. One clear conclusion from this exercise was that trying to buttress existing administrative allocation through collecting more extensive information from airlines about how they might use slots, for example by making them present business cases, is unworkable. It was strongly rejected by stakeholders as infeasible. Although such “beauty contests” have been used for some public assets, the complexity of the slot allocation is not amenable to this approach. It could also hinder secondary trading (in that airlines would have to honour the commitments they made to win slots in the first place) and so be a potentially retrograde step.

23. All the mechanisms we considered broadly have the ability to conform to the deadlines created by the IATA international scheduling conferences. However, some administrative processes run the risk of legal challenge which would cause delays, as parties who applied but did not get slots have much to gain and little to lose. Complex combinatorial auction formats may draw out bidding over a period that may be difficult to predict. However, a hybrid approach combining a simple auction format with detailed administrative scheduling has the advantage of providing a clear and robust process that can be concluded by a given date.

24. An allocation mechanism should be able to accommodate policy goals other than efficient use of scarce capacity in the narrow sense of slots being allocated to those with greatest willingness to pay. For example, all mechanisms considered would allow the protection of thinly used routes through the imposition of Public Service Obligations (PSOs). Market-based mechanisms could offer additional options, for example allowing regional bodies to buy slots in order to ensure access to London’s airports.

25. Common to all the proposals we considered was the suggestion that the new entrant rule should not apply to the allocation of a significant amount of new capacity. Some have argued that this may have a negative implication on the UK’s ability to negotiate further liberalisation of air traffic services under bilateral agreements because the new entrant rule provides a promise of favourable access to slots for foreign airlines with little or no presence at congested airports. Whilst there may be valid reasons to discriminate in favour of foreign airlines in some cases, this is not in itself a good reason to retain the new entrant rule; as currently formulated the effects of the new entrant rule reach much further than is necessary to create access to slots to support bilateral agreements.

26. All the mechanisms considered allow for foreign airlines to gain slots to support bilateral agreements. Indeed, market based primary allocation may
facilitate such access, as an entrant with a sufficiently strong business case could find it easier to secure slots.

1.7 Improving administrative allocation

27. One option is to reform the current administrative allocation system. Many of the industry stakeholders that we spoke to considered that the current allocation system works well except in situations of extreme oversubscription for slots and that there is merit in retaining this as a tried, tested and trusted system.

28. However, with the removal of the new entrant rule, the current secondary criteria are unlikely to be workable in the case of significant new capacity at a congested airport because of the high levels of oversubscription. Therefore, aside from the issue of the relative desirability of such an approach, relaxing the new entrant rule but otherwise maintaining the status quo is unlikely to be feasible. Improvement of this system would require refinement of the criteria used for administrative allocation.

29. Improving the current system would require rewriting of the secondary criteria. One option for the Slot Regulations would be to set broad objectives for slot allocation, such as:

- economically efficient use;
- promotion of competition;
- transparent and non-discriminatory access.

Member States would then be charged with implementing these principles. Ultimately such principles would need to be translated into simple rules that could be applied in an objective manner by the coordinator.

1.8 Fundamental problems with administrative allocation

30. Whilst it is feasible to develop improved administrative rules for slot allocation, we believe this approach would face a number of serious practical challenges:

- First, to define an appropriate set of stakeholders to include in the process of developing operational criteria representing both current and potential slot users;
- Second, to agree on the overall objectives for allocation when different stakeholders will inevitably have different interests;
- Third, the agreed objectives would need to be translated into criteria based on observable, non-disputable tests (such as long-haul vs. short-haul routes, aircraft-size, frequency of operation, etc.) that by their very nature could prove inflexible and formulaic.
31. Where administrative allocation uses simple rules it is likely to be inflexible and ineffective in pursuit of underlying public interest objectives that will require a mix of different types of services. Conversely, providing flexibility for the co-ordinator to pursue broader objectives rather than follow simple rules risks subjective decisions open to dispute.

32. Regardless of how extensively it is reformed, an administrative allocation system (or a system with administratively set prices) inevitably suffers from asymmetry of information between the administrator and users. The airport operator or the coordinator allocates slots, but only users of slots know how much value they can derive from the slots. On the grounds of practicality alone, there is a strong argument for using a market based approach to allow price discovery.

33. Often the criticism is levelled at proposals to auction airport slots that the process of implementation would be long and complex. However, developing an improved administrative allocation system would itself be difficult and resource intensive, and would still not address the problem of information asymmetry between coordinator and users.

1.9 Feasible auction formats

34. What we have called a ‘two-stage hybrid allocation process’ appears to be the most feasible approach for auctioning of new capacity. This combines:

- a relatively simple auction (first stage) that allocates ‘scheduling rights’; and
- detailed administrative coordination carried out by the coordinator (second stage) given the specific requests for timed slots from scheduling rights holders.

35. The full details of the auction format can only be finalised under the given circumstances of capacity to be released at a specific airport. For example, an auction for capacity on a third runway at Heathrow would be likely to be somewhat different to an auction for capacity resulting from a switch to mixed mode. Nevertheless, we have not identified any insurmountable problems to implementing this type of auction in any of these scenarios.

36. A significant practical advantage of a hybrid allocation process is that it could be used for new capacity whilst continuing to allocate existing capacity using the current system. This is particularly true if usage rights for new capacity were of indefinite duration. Therefore, this proposal would integrate well with existing approaches without requiring radical upheaval of the current allocation system.

37. Much previous work has focussed on the use of combinatorial auctions for airport slots, which are significantly more complex than our proposals. Such auctions would entirely replace the current coordination process and assign detailed slot timings and usage limitations. The significant advantage of these more complex approaches is that they may achieve a higher level of
efficiency, as they are able to take account of a wider range of trade-offs in how airport capacity might be used. However, stakeholders consider that such auctions would be highly complex and the results uncertain. Given the extensive development that such approaches would require, we do not consider that they provide a feasible approach for occasional auctions of new capacity in the short to medium term. However, such approaches should not be ruled out from future consideration.

38. The two-stage hybrid allocation process has some clear benefits over the combinatorial auction approach:

- The clock auction format used for the first stage allows price discovery without requiring bidders to make complex decisions. Bidders respond to announced prices with quantities of slots requested in a format that should tie into how schedule planning is currently carried out.
- It integrates well with the current administrative system and IATA deadlines.
- The hybrid approach retains the tried, tested and trusted element of the administrative system to determine detailed timings. The second stage is very similar to the coordination of historic slots and change requests that currently takes place.
- Within a permissive approach to the use of auctions, the first stage auction can be rolled out as a one-off, add-on element to the current system ahead of the release of a significant amount of capacity at an airport with scarcity problems.
- The scheduling rights can be designed appropriately and combined with low reserve prices to accommodate situations where excess demand only occurs at peak times.

1.10 Potential benefits of market based mechanisms

39. We have estimated the potential economic benefits from improving the efficiency of the allocation of slots at congested airports by introducing a market based approach to primary allocation. Although there are considerable uncertainties around any such calculations, there could plausibly be substantial economic benefits from more efficient primary allocation, even given modest increases in capacity and the possibility of secondary trading.

40. In the case of a 10% increase in capacity at London Heathrow, we estimate these benefits range from £0.8 to £3.6bn in net present value. In contrast we estimate that there would be a one-off cost of implementing an auction of £10-15mn, based on our proposal of a two-stage hybrid process using a simple clock auction. Given the scale of the potential economic benefits from more efficient allocation of scarce airport capacity, there is a strong case for allocating a significant amount of new capacity by auctions.
1.11 When are auctions most appropriate?

41. The benefits of auctions are contingent on capacity being scarce. If there is no scarcity, primary allocation is irrelevant as all potential users can get slots at or close to their preferred time without hindrance. In the absence of scarcity, the current administrative system would do as well as any other approach.

42. Absence of scarcity is not the same as there being excess supply of slots across the whole day or week; if there is excess demand for slots at peak times, then there is scarcity.

43. The lack of access to slots is a particular problem at London Heathrow. Although many industry stakeholders we spoke to pointed to the uniqueness of London Heathrow in this regard, the 2004 NERA study counted seven airports in the EU which experience excess demand throughout the day and another 14 airports where there is excess demand at peak times of the day. Therefore, following the appropriate definition of scarcity, there is scarcity at a significant number of EU airports, even though this is clearly a small minority. Therefore, auctions could be of benefit for allocating new capacity not just at Heathrow, though clearly this model is not necessary at all EU airports. Nevertheless, as passenger demand for air travel continues to grow, more airports across the EU are likely to experience scarcity in years to come.

44. At all airports with scarcity, there could be a benefit to using a market based allocation mechanism to allocate a significant amount of new capacity. Besides the implementation costs, there is little downside to using auctions, as if there is little scarcity then prices paid by bidders in the auction will be low as a result.

1.12 Developing the hybrid approach

45. We strongly recommend experimental testing of the two-stage hybrid allocation under a given hypothetical (though realistic) scenario for release of new capacity. This could involve industry participants who would bid in a mock auction given fictional strategies and budgets. Experimental testing of this type has been widely used for spectrum auctions. Such experimental testing would enable refinement of auction rules. It would allow the industry to understand more about auctions. It would also permit a more refined evaluation of the potential efficiency benefits of auctions given that our current estimates are based on models.

46. We are aware that a simulation exercise has been carried out in the US in relation to a potential auction of capacity at LaGuardia airport in New York. Unfortunately, the results of this exercise were not yet available at the time of writing.
1.13 Protecting competition

47. When contemplating the allocation of a significant amount of new capacity using a market based mechanism, it is important to ensure that this would not be detrimental to competition. There is a possible concern that a hub airline may have market power in downstream air traffic services markets derived from its large slot holding and that it could use this position to buy up slots in order to protect its market power. Therefore, it is important that powers are reserved to deal with competition problems.

48. There have been a number of competition cases and assessments of airline mergers. The definition of relevant markets adopted in these cases suggests that there is not an easily predictable link between slot holdings and competition in downstream air traffic services markets. Consequently, it is not possible to design a set of generic measures to counterbalance competition concerns that is appropriate to all airports at all times. The need for intervention will depend on case-specific analysis. Furthermore, it may be difficult to apply existing competition law to control slot concentration given the tenuous link between slot holdings and competitive conditions in any one particular relevant market for air transport services.

49. If competition is found to be a concern, a range of ‘soft’ measures may be appropriate, such as tweaking the auction design to encourage entrants and smaller airlines to participate. This may be appropriate to increase the effectiveness of competition even if no airline is dominant in the sense of competition law. For example, transparency in an auction could be restricted so that bidders cannot see who has requested how many slots at given prices during the course of the auction. ‘Hard’ measures such as quantitative limits on the number of slots any one bidder can win are likely to be disproportionate to the typical competition problems that might conceivably arise and, moreover, the detailed design of such restrictions would be difficult to determine objectively.

50. Some oversight of competition issues is required where auctioning is chosen as allocation method in a Member State. Auction design cannot be delegated to a coordinator owned by airlines or to the airport without some independent monitoring, as neither party has clear incentives to promote downstream competition.

51. A legal basis for assessment and intervention on competition grounds could be introduced in a revised set of Slot Regulations. This does not need to be onerous on airlines, airports or National Competition Authorities (NCAs). For example, new Slot Regulations could require proposals for slot auctions to be notified to NCAs a certain time in advance of implementation. NCAs would then have the power to request changes to the rules on competition grounds. There could be a presumption of permission, so that if the NCA had not raised objections within some time limit, the auction could go ahead. The details of how such an approach might apply would need to be explored further ahead of any revisions to the Slot Regulations.
1.14 Broad implications of revision of the Slot Regulation

52. This study strongly suggests that the most efficient use of slots would be gained from revising the Slot Regulations to allow auctions for primary allocation under a permissive approach. This would allow flexibility for individual Member States to design auctions based on demand and supply conditions at a given airport. The Slot Regulations should not be prescriptive about the format to be used. Experience from other industries shows that a successful auction requires careful consideration of specific local conditions.

53. A permissive approach would allow the UK Government to promote the efficient allocation of scarce airport capacity in the UK. This could bring significant benefits to users of UK airports. Consumers would benefit from allowing the uses of slots that generate the greatest consumer benefits and increased competition through lowering entry and expansion barriers. Although primary efficiency gains from using auctions in the presence of secondary trading might appear modest, the large contribution of the aviation sector to the UK economy means that these benefits are significant and far outstrip any implementation costs.

54. In the broadest terms, there is a noticeable difference to the approach taken in the current Slot Regulations to specifying how slots should be allocated and the approach that the EU has adopted for allocation of scarce assets in other sectors. The current Slot Regulations are detailed and prescriptive in how slots should be allocated, rather than setting broad principles and clear policy goals. An analogy to allocation of airport slots is the allocation of radio frequencies, which are also a scarce resource in some instances. In the case of radio spectrum, European policy is much more concerned with broad principles, such as efficient use, non-discriminatory access and ensuring that Member States cannot unreasonably withhold supply. Establishing similar broad objectives for slot allocation would seem desirable, with Member States then able to follow approaches appropriate to their circumstances.

55. UK airlines use other congested European airports and would benefit from being able to gain access where they have a strong business case against competing users. Hence there may be a case for considering whether a revised European Regulation should include an obligation on Member States to ensure that capacity is not unduly withheld and that new capacity is allocated efficiently and in a non-discriminatory manner. Such an obligation would not require the use of auctions or any other particular process of primary allocation by Member States. Nevertheless, this would create the opportunity for airlines in one Member State to seek redress if slot allocation in another Member State limited access without due cause.
2 Introduction

2.1 Terms of reference

56. The Department for Transport (DfT) has commissioned DotEcon in conjunction with AviaSolutions to undertake a study into alternative allocation mechanisms for new airport capacity. According to the project specification issued by the DfT, the required outputs from the study are:

- a clear assessment of the alternative options to allocate new runway capacity, including the circumstances where an auctioning mechanism may be most effective and the preferred alternatives when it is not;

- an allocation scheme for new capacity that can be evaluated against defined criteria, including costs and benefits, such that it can be shown to be effective, workable and commands broad support within HM Government and, preferably, stakeholders; and

- a scheme that can take account, where necessary, of external factors e.g. airline service scheduling, IATA’s slot coordination process, consistency with EU Regulations and international agreements.

57. The focus of this study is on primary allocation of slots, i.e. their initial allocation. Throughout, we assume that secondary trading is possible, so that current slot users can sell their slots to others. Any benefit of changing the method of primary allocation of slots must be assessed taking account of the potential for secondary markets to remedy inefficiencies in primary allocation.

58. The allocation of slots at coordinated airports in the EU falls within the scope of Council Regulation (EEC) no. 95/93 on common rules for the allocation of slots at Community airports of 18 January 1993 as amended by Regulation (EC) no. 793/2004 of 31 April 2004 (the Slot Regulation). The Slot Regulations specify the administrative procedure by which slots are currently allocated. We understand that the European Commission is currently undertaking a review of the Slot Regulations and is expected to table its proposals next year.

59. This study will assist the UK Government in forming its view on the desired changes to European slot regulations. The UK Government is committed to pursuing "a slot allocation system that encourages the more efficient use of scarce capacity". At congested airports this is most likely to be delivered by
Introduction

a market based approach.² Market-based primary allocation of slots is not possible within the current Slot Regulations.

60. The project specification is clear that this study is intended to look at alternative methods of allocating significant new capacity. This might arise from:

- a move from single to mixed mode runway use;
- other operational efficiencies; or
- by building additional runways.

It is UK Government policy to support the development of congested airports in the South East with the delivery of two new runways within 30 years.³ There are likely to be significant challenges in trying to allocate significant new capacity at heavily congested airports under existing arrangements.

61. The study does not consider the possible re-allocation of existing slots held under grandfathering arrangements. By considering new capacity only, this study can focus on developing practical proposals for slot allocation without having to consider complex issues such as who holds the property rights to current slots or possible reform of the existing system of grandfather rights.

62. We have not been asked to consider a mechanism that would apply to the allocation of pool slots held regularly ahead of every season. Rather, we are addressing a one-off event, such as the release of new capacity, though possibly phased over a number of scheduling seasons.

2.2 Approach taken

63. Prior to this final report, we submitted an interim report⁴ to the DfT summarising the first stage of the project. The first stage focussed on understanding the feasibility and practical implications of various primary allocation mechanisms, as well as an initial assessment of their relative desirability. We developed five allocation mechanisms⁵ that covered a wide range of alternatives. These formed the basis of bilateral discussions with

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⁴ DotEcon, “Investigation of alternative mechanisms for allocating slots created by new airport capacity, Interim Report”, 24 April 2006
⁵ DotEcon, “Proposed alternative allocation mechanisms for a significant amount of new airport capacity, for discussion with industry stakeholders”, 6 March 2006.
Introduction

airlines, airport operators, industry organisations and the airport coordinator. We summarise the consultation process in Annex 1.

64. The five mechanisms spanned a wide range of options from fairly minor modifications of the current administrative system through to a “big bang” auction replacing the entire existing coordination and allocation process. We describe the five mechanisms discussed with stakeholders in Annex 2. By fully articulating the mechanisms, we were able to investigate the practical difficulties associated with each mechanism.

65. Meetings with industry stakeholders provided us with direct feedback on the five proposed mechanisms. Written comments on our interim report were also invited and received from a number of parties. An anonymous summary of feedback from stakeholders is provided in Annex 3. Although many stakeholders were generally critical of the use of market based allocation methods, we nevertheless received useful and constructive feedback regarding potential practical difficulties that could arise with the various mechanisms. The feedback received since the interim report has been taken into account in this final report.

66. Many industry stakeholders believe that it is feasible to improve the current allocation mechanism by removing the new entrant rule and strengthening the criteria for prioritisation of slot applications. At the same time, there was also general agreement that it would be challenging to agree on revised criteria for an administrative allocation.

67. Although generally negative about the desirability of market mechanisms, many industry stakeholders commented constructively on the feasibility of a two-staged approach. This would combine a relatively simple auction with subsequent administrative scheduling similar to the current scheduling of grandfathered slots. This approach potential provides a much simpler and more practical alternative to the use of complex combinatorial auctions.6

2.3 Structure of the final report

68. This final report concludes the second and final phase of the study. In the second phase we have developed the two-stage, hybrid allocation process further based on the feedback received in the first phase. We have also considered how it might be possible to improve the existing administrative allocation mechanism. We have then assessed the costs and benefits of

using auctions against an administrative allocation method under favourable assumptions about the effectiveness of the administrative system.

69. This report is structured around the following sections:

- Section 3 discusses what we mean by economic efficiency and why achieving an efficient initial allocation of slots is important even if secondary trading is possible;
- Section 4 discusses the economic inefficiencies that prevail within the current administrative allocation system and what this tells us about the likely effectiveness of the current system for allocating significant new capacity;
- Section 5 presents the full range of available allocation mechanisms that we have considered and discussed with stakeholders;
- Section 6 outlines a possible process for developing the administrative allocation mechanism, preferred by many industry stakeholders;
- Section 7 develops the two-stage, hybrid allocation process, in which a simple auction would be used prior to administrative allocation;
- Section 8 considers whether introducing market mechanisms for primary allocation might lead to concentration amongst airlines and a reduction in competition that might require mitigating intervention;
- Section 9 considers issues relating to the definition of rights to use new capacity, such as the duration of usage rights and whether there might need to be any restrictions on use and tradability;
- Section 10 provides an estimate of the potential magnitude of the benefit that could result from using auctions for primary allocation at a congested airport;
- Section 11 develops our conclusions and recommendations.

70. In addition, the report contains a number of Annexes:

- Annex 1 summarises the process of consultation with stakeholders;
- Annex 2 details the five allocation mechanisms discussed with stakeholders (and subsequently revised in the light of comments received);
- Annex 3 provides an anonymous summary of feedback from stakeholders;
- Annex 4 provides an exposition of how secondary markets may be subject to certain limitations in the efficiency improvements that they can achieve when there are few transactions that auctions can at least partially outcome; and
• Annex 5 details our estimation of the potential benefits of auctions relative to administrative allocation in the presence of secondary trading.
3 Why does efficient primary allocation matter?

Summary

• Where slots are scarce, they should be allocated to promote economic efficiency in order to maximise the economic benefit to society from scarce airport capacity.

• An efficient allocation is achieved by allocating slots to users who would be prepared to pay the most for these slots, subject to certain conditions.

• Efficiency of allocation is an issue whenever slots are scarce. This is true for airports where slots are scarce at peak times only, as well as for airports with congestion throughout the day.

• Encouraging shifting of peak slot usage to off-peak times through appropriate incentives is important to maximise use of available airport capacity and avoid unnecessary capacity increases.

• The initial, primary allocation of new capacity matters even if there is secondary trading, because secondary trading can only remedy inefficiencies in the initial allocation of slots to a certain extent. Therefore, it is important to make primary allocation as efficient as possible.

• An inefficient initial allocation of slots also creates scope for windfall gains, reducing the revenues available from any auction to fund investment in new capacity or compensate those affected by the environmental impact of airports.

71. In this section, we consider why the initial allocation of airport slots matters even if there is the opportunity for secondary trading of slots. The main aim in allocation of scarce assets such as slots should be to achieve economically efficient outcomes, where overall economic benefits for society are maximised. We discuss what the concept of economic efficiency means in Section 3.1.

72. How slots are allocated matters only insofar as there are competing potential uses for them. At many EU airports, there is little if any scarcity of slots and so many of the issues relevant to highly congested airports do not need to be considered. We discuss the issue of scarcity in Section 3.2.

73. Throughout this report we assume that secondary trading of slots is possible. There have already been de facto trades in slots by means of
sequences of swaps. It is anticipated that any future revision of the Slot Regulations will formalise secondary trading. Our terms of reference are clear that we should assess various means for primary allocation of new capacity where secondary trading is possible.

74. This begs the question: if slots can flow to those who value them most through secondary trading, what extra benefit is there from using market mechanisms for primary allocation? This issue is central to the whole report. Therefore, we discuss the broad principles why primary allocation matters even when there is secondary trading in Section 3.3. Of particular concern are intrinsic limitations on the efficiency gains that secondary trading can achieve when there are few transactions. We discuss this issue in more depth in Annex 4.

3.1 What is economic efficiency?

75. Slot allocation should make the best possible use of the available airport capacity. The standard approach for public policy analysis is to seek to maximise the total economic welfare of affected parties, including:

- airlines and their suppliers (including airports);
- purchasers of air travel and air freight services, including both end-users and those using air transport services as an input into providing other goods and services (so-called downstream markets); and
- those affected by externalities (such as environmental and noise impacts).

76. Economic efficiency is achieved when consumer benefits (as conventionally measured by consumer surplus\(^7\)) and profits of suppliers are maximised, subject to considering any externalities on third parties. This means that we are giving equal weight to all affected parties and are unconcerned about the distribution of benefits between different parties.

77. Broadly, economic efficiency can be achieved by slots being allocated to those airlines who value them most, subject to two caveats:

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\(^7\) Consumer surplus is the difference between the benefits that consumers enjoy from consuming a good or service, less the price that they pay for it. For example, in the simple case of a good offered at a uniform price, consumers will purchase the good when their benefit from consuming it exceeds the price. For some consumers, the benefit may significantly exceed the price; for others, the benefit might only marginal exceed the price. Consumer surplus is defined by summing all of these benefits enjoyed. Such an approach is agnostic to the distribution of benefits amongst consumers (e.g. between different income groups) and is concerned only with the total quantum of benefit enjoyed by consumers as a group.
Why does efficient primary allocation matter?

- downstream markets for air transport services derived from slots need to be sufficiently competitive; and
- the slot allocation should not materially change external effects on third parties (such as noise and pollution).

In this case, we can largely equate the most efficient use of slots with slots going to the airlines prepared to pay most for them.

78. Where competition is effective, willingness to pay for slots will reflect cost efficiencies that airlines expect relative to their competitors or a superior customer proposition that they expect to be able to offer. Therefore, slots going to the airline with the highest willingness to pay will maximise economic benefits (subject to there being no externalities). The amount that airlines are prepared to pay for slots will depend on the extent and expected durability of advantages enjoyed over competitors. Provided competition is effective, airlines’ profits will be dissipated by competition over the long run, with profitability at a level necessary to provide a reasonable return on capital and no excessive profits being earned. Competition in air transport service markets caps the amount that airlines will be prepared to pay for slots.

79. For a given level of airport capacity, maximising economic efficiency is not simply a matter of maximising the number of slots in use at an airport. Some airlines and some destinations will generate more value than others, and hence it matters who uses slots, not just the number of slots in use. In many cases economic efficiency is likely to encompass maximising throughput at an airport, but in some cases there could be a limited trade-off between the number of air movements and the value generated by them. 

3.1.1 Ineffective competition downstream

80. If downstream air transport services markets are not fully competitive, then surplus will partially be captured as excess profits for airlines. Airlines’ willingness to pay for slots will not align with social value created where some airlines have market power. High willingness to pay for slots may reflect anticipated excess profits, rather than being as a result of superior efficiency or offering a more attractive proposition to customers. In this case, slots will not be efficiently allocated if they go to those with greatest willingness to pay.

81. Anti-competitive incentives to acquire slots are certainly a problem where airlines have sufficient market power to be dominant in the sense of

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8 For example larger aircraft may require further separation and reduce the number of available slots.
competition law. However, even if no airline is dominant, competition may not be fully effective and there may still be a significant component of airlines’ willingness to pay for slots that arises from the anticipated exercise of market power. Therefore, lack of competition in downstream markets may be an issue for the allocation of slots and needs to be taken into account in the design of the allocation mechanism. This is the case even where airlines are not dominant.

82. Whether or not competition issues will need to be taken into account in the design of a slot allocation process will depend on the circumstances at hand. There are no general conclusions, as there is wide variation in how the distribution of slots may influence the effectiveness of competition in downstream markets. Rather, specific analysis of the airport (or airport system) would be required. We discuss these issues in depth in Section 8.

83. For instance, an airline that holds a large proportion of slots at a particular airport and is willing to pay more for slots than other airlines does not necessarily have market power. Slots at a hub airport may simply be more valuable to that airline because there are network effects or economies of scale from its hub operations, which means that it can derive more value from slots than competitors. In that case, it would be efficient to allocate slots to a hub carrier providing that there was sufficient competition from other hubs to ensure that benefits were passed on to consumers.

84. Furthermore, when considering the allocation of new capacity, we must also consider the impact that new capacity could itself have on conditions of competition. A significant increase in capacity at a previously congested airport could lead to new entry and could relax barriers to existing carriers expanding. Both factors could lead to more competitive outcomes.

3.1.2 Externalities and slot allocation

85. There are a number of negative externalities from the building and use of airport capacity, such as noise, air pollution (NOX) and CO₂ emissions. Achieving economic efficiency in the broadest sense may require that such externalities are reflected in the price of airport usage or controlled through some other corrective mechanism.⁹

86. At congested airports in the UK, aircraft noise is currently addressed primarily through the use of quantitative limits such as caps on the number of aircraft movements and noise quotas and by a ban on scheduling the

⁹ The CO₂ emissions trading scheme is an example of how the Government may attempt to price in such externalities to produce pricing signals that incentivises firm and consumer behaviour towards an efficient outcome.
Why does efficient primary allocation matter?

The capacity statements issued by the airport operator ahead of slot allocation take runway, terminal and stand constraints as well as noise related operating restrictions into consideration when deriving the number of slots available for allocation. However, different types of aircraft produce different amounts of noise, so limiting the number of air movements may be too blunt an instrument by itself to achieve efficient noise abatement. This is a rationale for using separate noise quotas.

Airport operators currently have powers to structure their charges with reference to aircraft noise to reflect its impact on the vicinity (and larger airports frequently make use of this power). Therefore, there is already a potential role for prices to be used to encourage efficient noise abatement. The Civil Aviation Bill currently before Parliament will extend this power so that charges may also be fixed by reference to local air quality emissions from aircraft. Although there are currently no measures in place within the EU for CO₂ abatement in the aviation sector, clearly there is considerable public debate about this issue and future intervention is a possibility (subject to overcoming constraints imposed by various international agreements relating to air transport).

How does the use of market mechanisms for slot allocation affect the ability to correct for negative externalities such as these? Clearly where externalities are already addressed adequately by other policy measures (such as quantitative limits or appropriately set charges that reflect externalities), it is not necessary to consider them further within the slot allocation mechanism. Nevertheless, the use of market mechanisms for slot allocation does open up the possibility of integrating the control of negative externalities into the slot allocation process itself. This creates a broader range of policy options for how to deal with negative externalities.

In terms of slot allocation, there is no logical difference between slot scarcity created by limited physical infrastructure (runways, terminals and stands) and slot scarcity created by quantitative limits on external effects such as a noise or emissions quota. Combinatorial auctions can reflect all these various simultaneous constraints on slot allocation, in effect establishing a

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10 At the airports designated for the purposes of section 78 of the Civil Aviation Act 1982 (currently London Heathrow, Gatwick and Stansted), the Secretary of State sets noise related operating restrictions.

11 If a significant amount of new capacity were to become available at a highly congested airport, it may be possible to use some of the new capacity to reduce overall congestion. A sufficient reduction in congestion might even reduce noise and pollution impacts.

12 By efficient abatement we mean achieving a quota for noise or emissions whilst minimising the costs of abating this level. This means that the burden of reducing noise or emissions should be taken more heavily by those who can abate at least cost.
market price for each different type of capacity used, whether this is physical capacity or a share of a noise or emissions quota. Therefore, sufficiently sophisticated auctions can price such constraints and minimise the overall costs of abatement. This integrated approach has the advantage that airlines would acquire all the various rights needed to make an air movement in a single step, including rights to use physical airport capacity and rights to use part of an overall noise or emissions quota. This reduces risks for airlines as compared with, for example obtaining slots and the right to make emissions in separate processes.

90. This integrated approach to allocating slots together with noise and emissions quotas is theoretically attractive, but likely to be impractical in the short to medium term. There are three main problems:

- Such an approach requires sufficiently complex auctions, which we judge are impractical in that time frame. In particular, simple clock auctions of a given number of slots (our leading proposal) do not permit consideration of negative externalities other than by limiting the number of slots. To the extent that different types of aircraft (and modes of operation) given rise to different amounts of noise and emissions, some additional system for giving appropriate incentives for efficient abatement would be needed, such as differential usage pricing or tradable noise and emissions rights.

- The use of auctions is only considered for allocating new capacity. An integrated approach to slot allocation and control of negative externalities would be difficult because slots generated by the new capacity would be used alongside slots arising from existing capacity.

- For any future control of CO₂ emissions, efficient abatement would require consideration of the trade-off between abating in the aviation sector as compared with other sectors. This requires an economy-wide allocation process, which would not mesh well with an integrated system for allocating slots and emissions quotas developed specifically for the aviation sector.

91. For the purposes of this study, the most relevant conclusion to draw is that the use of market mechanisms for allocating new capacity is supportive of the control of noise and emissions externalities. A simple auction system (such as a clock auction) cannot take account of varying noise and emissions from different uses of slots by itself, so some parallel system for encouraging abatement would be needed. Nevertheless, provided that negative externalities are priced into the use of slots, both secondary trading and the use of auctions for primary allocation should encourage slots to flow to those who can reduce negative externalities. For example, if there are two potential users of a slot, but one can reduce noise more cheaply than the other (and so avoid charges related to noise) this will be reflected in a greater willingness to pay for the slot. Therefore, market mechanisms for slots will favour slots going to those who can cheaply and speedily abate noise and emissions provided that sufficient incentives for such behaviour are created by other policies.
3.2 Efficiency and scarcity

92. Efficient allocation of slots is only important where there are competing demands for slots that need to be resolved; that is, efficiency of allocation is only relevant at airports where there is scarcity of slots. At airports where there is no scarcity, slot allocation is not relevant as, by definition, potential users of slots can gain access to slots whenever they want.

3.2.1 Defining scarcity

93. In defining scarcity, the key question is whether potential users of slots can gain access to slots at or close to their preferred times without hindrance. This is not the same as there being excess supply of slots across the whole day or whole week. Even at highly congested airports like Heathrow, there are a small number of off-peak slots that are unused. Scarcity occurs whenever there is over-subscription of peak-time slots, so that some airlines cannot operate at their most preferred times or possibly not operate at all.

94. The recent NERA study\textsuperscript{13} identifies those EU airports with scarcity at some times in the day. NERA’s findings are reproduced in Table 1. There are a small number of airports where slots are scarce throughout the day (seven in total). However, there are a much large number (14 in total) where there is some scarcity at particular peak times. With anticipated continued growth in air traffic, scarcity of slots can only be expected to increase.

\textsuperscript{13} “Study to assess the effect of different slot allocation schemes – A final report to the European Commission, DG TREN”, NERA January 2004.
Table 1: Congested EU (15) airports, 2002

<table>
<thead>
<tr>
<th>Airports with excess demand throughout the day</th>
<th>Airports with excess demand at peak times of day</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dusseldorf (DUS)</td>
<td>Malaga (AGP)</td>
</tr>
<tr>
<td>Frankfurt (FRA)</td>
<td>Amsterdam Schiphol (AMS)</td>
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<tr>
<td>London Heathrow (LHR)</td>
<td>Brussels (BRU)</td>
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<td>Paris Charles de Gaulle (CDG)</td>
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<td>Madrid Barajas (MAD)</td>
<td>Dublin (DUB)</td>
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<tr>
<td>Paris Orly (ORY)</td>
<td>Rome Fiumicino (FCO)</td>
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<td>Berlin Tegel (TXL)</td>
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<td>Vienna (VIE)</td>
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Source: NERA 2004, table 3.2

3.2.2 Efficient capacity levels at airports

95. At an airport where there is over-subscription of peak-time slots and unused slots at other times of the day, a clear advantage of economic charging mechanisms (i.e. prices that reflect scarcity) is that it creates an incentive for peak-time slot users to migrate to off-peak times. This improves utilisation of airport assets and can avoid the need for inefficient expansion of airport capacity. This is a potentially significant benefit of market based approaches to primary allocation, though even administratively set peak and off-peak charges might secure some of the benefit. It is not necessary that there is excess capacity throughout the day for there to be potential benefits from using economic charging mechanisms.

96. Market-based mechanisms can potentially assist in determining the appropriate amount of airport capacity. Where the value placed on slots, revealed by market mechanisms, exceeds the costs of providing these slots...
Why does efficient primary allocation matter?

(excluding external impacts), it is desirable to increase capacity. Market mechanisms for both primary and secondary allocation are able to reveal useful information about the value of slots.

3.3 Primary allocation where there is secondary trading

Facilitating secondary trading can be expected to substantially increase the efficiency with which slots are used. Secondary trading can:

- allow correction of any inefficiencies in how slots are first allocated; and
- allow slots to change hands in response to changing circumstances amongst airlines.

Throughout this report we refer to secondary trading and the secondary market, by which we mean the practice of swapping slots with or without a financial consideration. Slot trading at present may require a sequence of slot swaps. The buyer can apply for an unwanted off-peak slot, swap it with the seller for the target slot - for which the seller receives some financial payment - and hands the unwanted off-peak slot back to the administrator. This swapping procedure is necessary due to the prohibition in the current slot regulation on direct sales of a slot from one airline to another. Clearly the effect of the swap is in practice equivalent to a direct sale. In the UK, the Guernsey decision\(^\text{14}\) has established that the current practice of swapping slots accompanied by a financial transaction complies with the Slot Regulations.

In our discussions with stakeholders, many airlines emphasised that formalising secondary trading in slots would provide an important commercial freedom, providing the flexibility to scale up and down their operations and reconfigure slot timings. Therefore, there is a strong case that allowing secondary trading brings benefits, regardless of the mechanism used for initially allocating slots.

To the extent that primary allocation is not efficient, we can expect two main problems, even with well-functioning secondary trading:

- Secondary trading may remedy some inefficiencies in primary allocation, but cannot remedy them all. Therefore, slots may not end up being held by those who value them most.
- Even if secondary trading leads to slots being held by their highest value users, inefficient primary allocation creates windfall gains, which

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\(^{14}\) R v Airport Co-ordination Limited ex parte The States of Guernsey Transport Board, QBD, Kay J, 25.03.99.
in turn can lead to speculative demand for slots and saps a potential
source of revenue for providing the capacity in the first instance.

3.3.1 Limits on the efficiency of secondary trading

101. Even if unencumbered secondary trading of slots is possible, this does not
mean that the method by which new capacity is initially allocated is
unimportant. There may be unavoidable imperfections in secondary
markets, so that some, but not all, of the potential benefit of secondary
trading may be achieved. Because of these imperfections in secondary
markets, the method by which slots are initially allocated matters. Some
inefficiencies created at the point of initial allocation of slots may persist
over time.

102. In assessing the potential benefit of using auctions, we must take account of
the extent to which secondary trading could achieve reasonably efficient
allocation of slots regardless of the means of primary allocation. Clearly the
additional efficiency benefits resulting from using auctions for primary
allocation as opposed to using an administrative allocation method are
related to removing inefficiencies that secondary trading alone cannot
resolve. Therefore, understanding secondary market inefficiencies is
essential to any estimation of the benefits of using auctions.

103. The secondary market for slots would be best described as a sequence of
bilateral transactions negotiated between the parties involved. Therefore,
sellers and buyers have had to identify each other and agree terms. There
are many hurdles at which a transaction may fail, even if it would be
efficient for the two parties to trade.\(^{15}\)

104. There are three main sources of secondary market inefficiencies that are
relevant to secondary markets in airport slots\(^{16}\):

- inefficiencies resulting from bilateral bargaining;

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\(^{15}\) Buyers and sellers of houses will be personally familiar with various ways in which
secondary trades may fail.

\(^{16}\) In general, there is a fourth class of problem that can arise in secondary markets:
so-called adverse selection where the quality of the item being traded is uncertain
and the trading parties may have asymmetric information about quality. Trade may
fail to occur because the seller knows more about quality than the buyer. This can
create a so-called 'lemons problem', where the seller lowering the price to attract
buyers is interpreted as a signal of poor quality, reducing rather than increasing
demand. Given that airport slots have defined characteristics, this issue is not
particularly relevant for most the scenarios we consider. However, this issue could
be relevant for the secondary trading of scheduling rights defined by priorities as
discussed in Section 7.1.2. For example, if the holder of a Priority 2 scheduling right
also holds a number of Priority 1 scheduling rights, it will know more about the
likelihood of securing a slot at a particular time within the scheduling system than
might a potential buyer of the right.
Why does efficient primary allocation matter?

- transactions costs;
- costs and difficulties in identifying parties with which to trade (search costs).

105. The extent of these various problems depends on the nature and organisation of secondary markets. Some of these problems can be reduced by formalising secondary trading, for example a central clearing house may emerge to reduce transaction and search costs. Other problems such as bargaining inefficiencies may remain.

106. To date, the secondary market for airport slots has been relatively thin. Table 2 shows recent trading volumes, including slot swaps of equal value and slot swaps accompanied by a financial payment. Whilst volumes were higher in 2002, reflecting reorganisation in the industry following the demand shock caused by 9/11, they are currently around the 1-2% per annum level.

Table 2: Volumes of slot transfers at LHR, summer and winter seasons 2002-2006

<table>
<thead>
<tr>
<th></th>
<th>Transfers (slots per week)</th>
<th>Total ATMs (per week)</th>
<th>% transferred per season</th>
</tr>
</thead>
<tbody>
<tr>
<td>S02</td>
<td>398</td>
<td>9300</td>
<td>4.28%</td>
</tr>
<tr>
<td>W02</td>
<td>357</td>
<td>8971</td>
<td>3.98%</td>
</tr>
<tr>
<td>S03</td>
<td>236</td>
<td>9256</td>
<td>2.55%</td>
</tr>
<tr>
<td>W03</td>
<td>172</td>
<td>9042</td>
<td>1.90%</td>
</tr>
<tr>
<td>S04</td>
<td>262</td>
<td>9354</td>
<td>2.80%</td>
</tr>
<tr>
<td>W04</td>
<td>109</td>
<td>9091</td>
<td>1.20%</td>
</tr>
<tr>
<td>S05</td>
<td>68</td>
<td>9383</td>
<td>0.72%</td>
</tr>
<tr>
<td>W05</td>
<td>130</td>
<td>9182</td>
<td>1.42%</td>
</tr>
<tr>
<td>S06</td>
<td>111</td>
<td>9427</td>
<td>1.18%</td>
</tr>
</tbody>
</table>

Average 2002-03 3.18%
Average 2004-06 1.46%

Source: ACL data

3.3.2 Bargaining inefficiencies

107. Bilateral bargaining between buyer and seller may fail to agree a price at which both are willing to trade. We explore this issue in depth in Annex 4, as it is a key consideration in our assessment of the benefits of auctions. In a bilateral exchange, the seller pushes for a higher price and the buyer a lower price in order to capture a greater share of the total benefits of the
transaction. Because the seller does not know what the buyer will accept (and vice-versa), there is always a danger that efficient transactions could fail to occur through the buyer and seller making rational yet irreconcilable demands.

108. This problem is intrinsic to markets that are based on bilateral transactions. The only way to avoid these problems is if trading volumes increase to the extent that there are large numbers of buyers and sellers, permitting different types of market institution to be used. For instance, with many small buyers and sellers, it may be possible to match trades and set a market-clearing price, much like a financial market. Where many individual buyers and sellers participate in an intermediated market where they have little or no influence on the outcome, limitations created by bargaining efficiencies can be overcome.\textsuperscript{17} However, there is no reason to expect volumes of secondary trading in airport slots to support these more efficient forms of market organisation.

3.3.3 Transaction costs

109. Transactions costs are costs of making trades that buyers or sellers need to incur, and these may act as an impediment to some potential transactions that would bring low or modest gains from trade. In the context of airport slots the main transaction cost would probably be the cost of drawing up a legal and financial agreement between two airlines for the transaction.

110. Although case precedent suggests that secondary trading is allowed within the current Slot Regulations, there is arguably still some legal uncertainty around secondary trading. Removing this uncertainty by formalising secondary trading, clarifying the legal status of a slot as well as avoiding the need for swapping slots would lead to a modest reduction in transaction costs.

3.3.4 Search costs

111. Before a buyer and seller can even begin the process of negotiating a mutually acceptable price for a trade, it is necessary for them to identify each other as potential trading partners. Where transactions volumes are fairly low, this is not necessarily straightforward. There may be delays associated with buyers finding sellers (and vice-versa), reducing the efficiency of secondary markets.

\textsuperscript{17} There are various so-called ‘limit efficiency’ results that show that with many atomistic buyers and sellers, secondary markets can be efficient. See, for example, Hurwicz L. (1972) "On informationally decentralized systems", in "Decision and Organisation", ed. M. McGuire and R. Radner, Noth-Holland.
Why does efficient primary allocation matter?

112. Search costs can be reduced by using certain market institutions to match buyers and sellers. For example, in a formalised secondary market a central clearing house where buyers and sellers can post their intentions may emerge to improve the efficiency of the secondary market. A clearing house might take buy and sell offers and match these automatically using some rule, as for example happens in many financial markets. However, the success of such market institutions depends on there being sufficient volume of trade. In a thin market, a seller might post a sell offer, but could need to wait a significant time until an appropriate buyer came along. Therefore, whilst it might be possible to reduce matching and searching problems through appropriate organisation of the secondary market, these cannot be entirely eliminated.  

3.3.5 Problems created by windfall gains

113. Where the primary allocation has not awarded a slot to the highest value user, the winner of the slot can realise a windfall gain from secondary trading. Although this leads to the slot eventually going to the highest value user, this may have the knock-on effect of creating incentives for parties to apply for slots speculatively in the hope of selling them on. This speculative demand for slots may increase the complexity and cost of the primary allocation system.

114. These windfall gains may be a policy concern in their own right. First, the over-subscription problem that they create may be severe. For example, the FCC ran lotteries for radio spectrum in the US at one time, prior to moving to auctions. There were massive numbers of applications from speculators wishing to sell on spectrum. Whilst over-subscription might not be too concerning with a lottery, where there are administrative elements to the allocation process (even if this is just checking credentials), the burden can soon become unmanageable.

115. Second, revenues from the sale of slots in a market mechanism can create useful information for the airport in planning capacity increases and can fund new investment. Where the allocation mechanism creates windfall gains, these revenues are effectively transferred to speculators and so are not available to fulfil these functions. These revenues are not then available either to fund new investment or to compensate for environmental impacts of airports.

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18 See also “Competition issues associated with the trading of airport slots”, A paper prepared for DG TREN by the UK Office of Fair Trading and Civil Aviation Authority, June 2005. This paper discusses the various measures that may be implemented to improve the functioning of a formal secondary market but concludes that there is little justification for forcing trades to be conducted in a certain way. Whilst market institutions may well evolve to reduce the impact of transactions costs, matching and searching problems, they typically cannot be entirely eliminated.
4 Allocation of new capacity within the current system

Summary

• The current administrative allocation system is highly likely to produce an inefficient allocation of new capacity.

• The coordinator is not able to observe the relative value that airlines place on slots. Therefore, slots are not necessarily awarded to those who can generate greatest economic value from them.

• The new entrant rule leads to excessively fragmented outcomes. Only the smallest airlines benefit from the new entrant rule, reducing the availability of slots to those contesting the market shares of larger airlines. Competition may be hindered rather than helped, with the detriment ultimately falling on consumers.

• There is a vicious circle whereby inefficient allocation leads to excessive incentives to hold on to slots, limiting the size of the pool and impeding secondary trading.

• There are a variety of observed behaviours of airlines that are consistent with the current allocation of pool slots being inefficient.

116. The Government has stated in its aviation White Paper\textsuperscript{19} that it believes the “current allocation system contains fundamental weaknesses” and that it is problematic that the slots at congested airports are not necessarily awarded in a way that reflects their true value or benefits to consumers and the economy. “The Government wishes to see a slot allocation system that encourages the more efficient use of scarce capacity.” This section looks at how new capacity would be allocated within the present system and the inefficiencies that would be likely to arise at capacity constrained airports.

4.1 The slot pool and the new entrant rule

117. Every season, the majority of slots at coordinated airports in the UK are allocated according to historic usage, or so-called “grandfather rights”. Table 3 below shows the proportion of capacity allocated at coordinated

\textsuperscript{19} “The Future of Air Transport“, Department for Transport, December 2003
airports in the UK and hence the maximum share of capacity eligible for grandfather rights in the following season.

**Table 3: Summer 2006 slots allocated versus total capacity**

<table>
<thead>
<tr>
<th>Airport</th>
<th>Weekly slots allocated</th>
<th>Weekly total slot capacity</th>
<th>Slots held compared with total capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>London Heathrow</td>
<td>9,317</td>
<td>9,527</td>
<td>97.8%</td>
</tr>
<tr>
<td>London Gatwick</td>
<td>5,261</td>
<td>5,621</td>
<td>93.6%</td>
</tr>
<tr>
<td>London Stansted</td>
<td>3,880</td>
<td>5,089</td>
<td>76.2%</td>
</tr>
<tr>
<td>Manchester</td>
<td>4,652</td>
<td>6,251</td>
<td>74.4%</td>
</tr>
</tbody>
</table>

Source: ACL, AviaSolutions

118. In the current system, capacity not allocated on the basis of grandfather rights forms the ‘slot pool’ available for allocation to new slot requests. The slot pool consists of:

- any new capacity;
- previously unused slots; and
- slots returned to the pool voluntarily or under the ‘use it or lose it’ rule.

119. As can be seen from Table 3, the pool of slots available for allocation at the most congested airports in the UK (Heathrow and Gatwick) is relatively small. There are examples of the current system having allocated large amounts of new capacity, such as the opening of the second runway at Manchester Airport in 2001, but there was not significant excess demand in this case.

120. New entrants are given priority for up to 50% of pool slots, where a new entrant is defined as:

- an airline who, if the slot request was met, would hold less than five slots at that airport on that day;
- an airline requesting slots for an intra-Community route operated by at most two other airlines and where, if the slot request was met, the airline would hold less than five slots at that airport on that day for that route; or
- an airline requesting slots for a scheduled service to a regional airport where no other airline operates a service to the airport on that day and where, if the slot request was met, the airline would hold less than five slots at that airport on that day for that service.
This definition of a new entrant means that reserved slots benefit only the very smallest airlines at congested airports.

121. Furthermore, priority is given to requests to operate slots on a year-round basis. Requests to continue operating a slot from one season to the next (e.g. from summer to winter) have priority over a slot requested in that season for the first time. Such “year-round continuations” may also qualify for new entrant priority.

122. There is also a set of “secondary” criteria (where the primary criteria have established the priority of grandfather rights and requested changes to grandfathered slots as well as the new entrant and year-round continuation priority to pool slots). These secondary criteria are expressed in broad terms:

- effective period of operation;
- size and type of market;
- competition;
- world-wide scheduling constraints e.g. curfews;
- requirements of the travelling public;
- frequency of operation; and
- local guidelines.

In addition, the coordinator also takes other local constraints specific to UK airports into consideration such as night flying restrictions, traffic distribution rules and licensing and bilateral issues.

123. Slots are considered by the coordinator on a day-by-day and hour-by-hour basis and allocated as a specific time (in five minute increments) for either take-off or landing. For each slot available, the coordinator considers which airlines are requesting slots around that time and identifies those requests as potentially competing. The coordinator takes decisions based on the combination of slot allocations that accommodates as much demand as possible, complies with the allocation criteria, and results in operationally and commercially feasible airline schedules. The coordinator’s computer system contains a mathematical model of airport’s capacity and scheduling limits and allocation decisions are taken that fit within the overall scheduling limits.

124. At present, the slot pool at London Heathrow is relatively small compared with the overall number of slots. As implied by Table 3, there were approximately 200 weekly slots in the pool for the 2006 summer season, or less than 3% of total capacity. The majority of these pool slots are at times that are considered commercially unattractive, are not at similar times across days of the week and have specific terminal constraints. As a result, there are a limited number of requests that match the available slots. These
practical limitations simplify the coordination problem and aid the coordinator in allocating pool slots under the current system.

4.2 Inefficiencies in the current system

4.2.1 Sources of inefficiency

125. Inefficiencies in the current allocation system arise from:

- the inability of the system to consider the economic value generated by different potential users of the slot;
- the supply of slots being constrained by the new entrant rule;
- an excessive incentive to hold on to slots, which creates a vicious circle further limiting slot availability;
- the incentive for speculative applications; and
- knock-on effects which may restrict downstream competition in air transport services markets.

126. The fundamental problem with the current administrative mechanism is that allocation rules cannot be based on the economic value that a user of a slot generates, whether indicated through willingness to pay or proxied by some other means. The most relevant information for efficient allocation is simply unobservable to the coordinator.

127. In contrast to a market based system, airlines’ willingness to pay reflects the value that they expect to be able to generate from access to airport capacity. Provided competition is effective, an efficient allocation can be achieved by allocating slots to those with the greatest willingness to pay. Processes such as auctions elicit information about willingness to pay by creating competition for slots.

128. In the current administrative system it is impossible to take account of airlines relative slot valuations in a systematic manner, as information about willingness to pay for slots is not elicited. Therefore, when new capacity becomes available, it will very likely be the case that:

- slots are not always allocated to those who place highest value on them; and in particular,
- the allocation of slots may not reflect relative ability of airlines to switch to different timings, e.g. peak and off-peak.

129. The current administrative system attains a very high degree of usage of congested airports. However, even if every single slot arising from new capacity was allocated according to the current administrative system and full utilisation of the new capacity achieved, this is unlikely to be an economically efficient allocation. The coordinator lacks information to determine which airline can generate the most value from a slot.
130. The new entrant rule imposes a significant constraint on the allocations that the coordinator can implement. There is no reason to suppose that the new entrant rule leads to slots being allocated efficiently, as this would require that any airline satisfying the new entrant conditions necessarily generated greater value from slots than any other airline not satisfying these conditions. However, the new entrant rule is not the only source of inefficiency; sources of inefficiency would exist even without the new entrant rule.

131. The lack of access to airport capacity creates strong incentives to hold on to slots. The current users of slots enjoy a substantial option benefit. It may be entirely rational for the current user to hold on to a slot in the face of an offer from another potential user that exceeds the profits the slot currently generates; the slot might be more profitable for its current user in the future and there may be considerable difficulties in buying a corresponding slot back later if a slot is sold now. This in turn means that there are less slots available in the pool, creating a vicious circle where incentives to hold on to slots inefficiently become even greater.

132. A further aspect of the administrative system which complicates the allocation of slots is the speculative applications that it generates. This results because users do not pay for slots according to the opportunity cost. As a result, even an inefficient user of a slot gains a significant benefit from being allocated a slot. The surplus of applications makes it more difficult for the administrator to assess which application would have a higher valuation of the slot.

133. Speculative applications may also be generated by the prospect of new capacity being available. ACL told us that they have experienced increases in slot requests in the seasons ahead of new capacity becoming available. Speculative requests are also evident at airports that currently have significant capacity available. For example, Table 4 shows the increase in slot requests for the summer 2006 season compared to historic holdings in the summer 2005 season (first column). At London Heathrow and Gatwick, the pool is relatively small and only a small proportion of these requests were met (second column). However at London Stansted and Manchester the majority of these requests were met, but airlines did not actually operate the requested slots (third column).
Table 4: Slot requests, allocations and actual use of slots, summer season 2006 compared with year before.

<table>
<thead>
<tr>
<th>Slot requests</th>
<th>Slots initially allocated</th>
<th>Slots actually operated</th>
</tr>
</thead>
<tbody>
<tr>
<td>London Heathrow</td>
<td>+14%</td>
<td>+1.2%</td>
</tr>
<tr>
<td>London Gatwick</td>
<td>+22%</td>
<td>+6%</td>
</tr>
<tr>
<td>London Stansted</td>
<td>+26%</td>
<td>+25%</td>
</tr>
<tr>
<td>Manchester</td>
<td>+19%</td>
<td>+18%</td>
</tr>
</tbody>
</table>

Source: ACL, AviaSolutions

134. In addition to the immediate sources of inefficiency described above, there are also a number of knock-on effects. The lack of access to slots and the inability to reschedule operations outside own slot holdings causes a loss of operating flexibility for airlines, which will raise costs and may in some cases act as a competitive restriction detrimental to consumers.

135. Competition may also be restricted by the barrier to entry and expansion that is created for those airlines that do not receive slots in the primary allocation but have to buy slots in the secondary market. Acquiring slots in the secondary market may be difficult for the reasons discussed above. Furthermore, a distortion of competition may be created as slots are given free of charge in the primary allocation but are costly to acquire in the secondary market. The administrative system produces windfall gains to beneficiaries of slots from the pool. Such windfall gains may not have a direct impact on economic efficiency (although they would seem unfair) but can have a secondary impact on competition. If the recipient competes in the same market (for example if a particular route constitutes a separate market) as non-recipient, the windfall gain will constitute a subsidy to one competitor. Therefore, even with secondary trade possible, inefficient primary allocation creates the possibility of competitive distortions.

4.2.2 Signs of inefficiency

136. Various phenomena consistent with an inefficient primary allocation can currently be observed at congested airports:

- inefficient allocation of pool slots due to the new entrant rule:
  - entrants likely to hand back or sell pool slots; and
  - secondary market transactions driven by lack of success in the pool;
- babysitting; and
• a thin secondary market, i.e. we do not see as many transactions in the secondary market as would be efficient.

There are of course other possible explanations for these types of behaviour other than an inefficient primary allocation. Nevertheless, the strong a priori arguments for expecting inefficient allocation from the current system coupled with specific predictions about behaviour of airlines borne out in practice creates a strong case for there being inefficiencies.

137. As discussed in the previous section, the new entrant rule may prevent slots from being allocated to the airlines that can generate most value from given airport capacity. Entrants are likely to hand back or sell pool slots once able to do so. Between 1997 and 2004, 20 airlines commenced services from London Heathrow solely using pool slots. However, of the 146 weekly slots which were allocated to new entrants over this period, 19% of slots have been sold or transferred, 42% handed back and 38% are still operated. It should be noted that this ‘churn’ in slots is not necessarily purely an indication of inefficiency as new entrant services are often at the periphery of the operating day and thus at less commercially attractive times and more at risk of failure. Churn also occurs amongst incumbent carriers, but may be less visible as it does not usually result in complete market exit.

138. Inefficiencies in the primary allocation can also be observed in secondary market transactions driven by lack of success in acquiring slots from the pool. There are several examples of incumbent airlines actively buying slots in the secondary market meanwhile getting a relatively low proportion of pool slots. This shows how pool slots are not necessarily allocated to the airlines with the highest willingness to pay for such slots and is direct evidence that the allocation of pool slots is inefficient. For example in summer 2004:

• Qantas received 10% of the number of slots transferred in the secondary market at London Heathrow but were only allocated 4% of the pool slots;
• Virgin Atlantic accounted for 21% of the number of slots transferred in the secondary market but only received 8% of pool slots in the same season; and
• British Airways acquired more than 50% of the number of slots transferred in the secondary market but was only allocated 16% of pool slots in the same season.21

Some of this behaviour may have been driven by carriers turning to the secondary market because peak time slots were not available from the pool.

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20 Source data provided by ACL
21 Source data provided by ACL
Nevertheless, there are large differences between demand for slots in the secondary market and success in the primary allocation.

139. Inefficient allocation creates inefficient incentives to maintain control of slots. This in turn leads to other behaviour that would be unlikely if allocation were efficient. One example is “babysitting”, where an airline agrees to another airline using its slots for a temporary period. For example, Air France continued to operate 14 slots per week at London Heathrow for Jet Airways for a further year after having agreed to sell these to Jet Airways until Jet Airways had the required long haul aircraft to operate services to India. It can be argued that this behaviour has also been driven by inefficiencies in the secondary market, as buying and selling slots fluidly to match immediate operating requirements is not practical.

140. Babysitting is a result of the lack of availability of slots combined with the ‘use it or lose it’ rule attached to grandfather rights. When capacity is available it may not be efficiently allocated, and attempts to obtain slots on the secondary market are uncertain due to market imperfections. Therefore, rather than giving up slots when they are not needed and buying them back when they are, airlines have incentives to hold on to slots even if this means babysitting them.

141. This incentive to hold on to slots leads to the secondary market being thin, i.e. that we do not see as many transactions in the secondary market as would be efficient. This is a vicious circle, as a thin secondary market in turn increases the incentive to hold on to slots. Inefficient primary allocation further raises these incentives by reducing the chances that high value users of slots will secure them.

142. We do not have any immediate benchmark for the proportion of slots that would be traded in an efficient secondary market to compare to the current level of transactions. Nevertheless, there are surprisingly few trades at congested airports. For example, in the winter 2005 season at London Heathrow, 130 weekly slots were traded out of a total of 9,204 slots initially allocated.22

4.3 Potential benefits from reform of new entrant rule

143. There are good reasons to suppose that the new entrant rule frustrates efficient allocation as discussed in Section 4.2.1. Hence there is a potential efficiency gain from reform or removal of the new entrant rule. Reform of the new entrant rule is common to all of the mechanisms we have considered.

22 See also Chapter 4 of NERA, “Study to assess the effect of different slot allocation schemes – A final report to the European Commission, DG TREN”, January 2004 for a discussion of indicators of inefficiency in the current system.
144. The new entrant rule may also operate as a restriction on competition to the detriment of consumers, rather than enhancing competition. What constitutes effective competition may vary from airport to airport and between routes at a given airport and may not be assisted by pre-defined rules. Low-frequency airlines cannot necessarily compete effectively with high-frequency airlines with dense schedules due to the differentiation of service quality. The new entrant rule may operate as a barrier to expansion and lead to too many small operators that are not effective competitors to larger operators. This is particularly true of any sort of hub operation. The new entrant rule does not benefit consumers because it is unlikely to facilitate competing airlines deliver good, frequent services in a cost effective manner as demanded by customers.\textsuperscript{23,24}

145. In general, the new entrant rule does not fit well with further development of the secondary market. New entrant slots are given to particular airlines to facilitate entry or to operate particular routes. When such slots change hands in the secondary market there are no restrictions on use of such slots except the general scheduling restrictions. The provision also creates a route for speculative acquisition of slots for resale as acknowledged in the current two-year restriction on transfer of slots obtained under the new entrant rule. This problem would remain even with modification of the rule to broaden the definition of new entrant. In fact, the speculative motive could become even stronger.

\textsuperscript{23} Nevertheless, there may be instances of particular routes where the new entrant rule could potentially stimulate competition by allowing low frequency point-to-point services. However, such services may not be in head-to-head competition with the services of larger high frequency or densely interconnecting services. \textsuperscript{24}

\textsuperscript{24} See also section 2 of “Competition issues associated with the trading of airport slots, A paper prepared for DG TREN by the UK Office of Fair Trading and the Civil Aviation Authority”, June 2005, OFT 382 for a brief discussion of the impact on competition of the new entrant rule.
5 The range of alternative options

Summary

• We have considered a range of alternative allocation mechanisms, from revisions of the current administrative process through to a “big bang” auction replacing the current allocation system entirely. Common to all the options is the proposal that the new entrant rule should not apply to allocating new capacity.

• These proposals were discussed with stakeholders to determine where there might be practical problems with particular options.

• We conclude that a two-stage hybrid approach combining a relative simple auction of scheduling rights with administrative coordination of specific slot timings is the most feasible and practical approach.

• We excluded more sophisticated combinatorial auctions that could replace the entire existing administrative process in a ‘big bang’ as being too burdensome for bidders in one-off allocations of new capacity.

• All options are broadly compatible with the IATA timetable, though administrative processes may be more prone to delay by legal challenge. Complex combinatorial auctions may run for an unpredictable time, making simpler auctions advantageous.

• Using auctions might well ease lack of access to slots to support negotiations concerning bilateral agreements. There is no general case for discrimination in favour of foreign airlines under new bilateral agreements when allocating slots.

• With the two-stage hybrid approach, allocating scheduling rights once the amount of available new capacity is known and then determining detailed slot timings with the allocation of the pool would mesh with airlines’ investment and planning timetables.

• All the options are consistent with reservation of capacity for regional air access objectives. Market-based allocation would additionally allow visibility of the opportunity cost of such a reservation or allow regional bodies to bid directly for slots.

146. In this section, we briefly describe the various alternative allocation mechanisms that we have considered over the course of this study. A more detailed description of the mechanisms discussed with stakeholders is
included as Annex 2. Some of these proposals have subsequently been refined in the light of stakeholder feedback. In the discussions with industry stakeholders, our emphasis was on understanding the practicability of each mechanism. Annex 3 lists the main comments made by stakeholders in response to the alternative allocation mechanisms.

147. Although we present five different mechanisms here, two market based and three administrative mechanisms, the mechanisms should not be considered as distinct and separate choices. In fact some of them contain common elements and many can be hybridised. We focussed on these five mechanisms purely to span the range of alternative allocation methods in a manner that that could be presented to and discussed with stakeholders.

148. Some of the mechanisms involve airlines paying for slots whilst others do not. At this point in time, it has not been decided where any revenue generated from the award of new capacity would go. While we appreciate that this is an important question for industry stakeholders, we have only been asked to develop a practical proposal for how market mechanisms may be used to allocate slots without considering who should receive any proceeds.

5.1 Status quo

149. Before considering alternative allocation mechanisms it is worth noting that maintaining the status quo is also a feasible alternative. The current administrative system (with the new entrant rule) could achieve an operationally feasible allocation of new capacity though, as argued in Section 4, this would not lead to an efficient allocation of capacity. The secondary market would be able to remedy the inefficiency of the primary allocation to a large extent, but subject to certain inherent limits as discussed in Section 3.3. Trades in the secondary market would produce windfall gains for the airlines awarded slots in the primary allocation. Whilst windfall gains may not necessarily be a problem for efficiency and competition, they may be a problem for policy for the various reasons discussed in Section 3.3.5.

5.2 Administrative allocation mechanisms

5.2.1 Improvements on current system

150. We first considered reform of the current administrative system by removing the new entrant rule and revising the criteria for prioritisation of applications. The new entrant rule may prevent an efficient allocation of slots and is a poor measure for promoting competition in downstream markets.

151. Under this amended mechanism, airlines would request specific slot times as they do under the present system, specifying type of aircraft, number of seats, destination, whether the movement is an arrival or departure and whether the application is part or full season. Slots would be considered by
the coordinator on an hour-by-hour and day-by-day basis, as with the current allocation system. For each hour, the coordinator aggregates demand and compares this with the available slots.

152. Without the new entrant rule, the allocation would rely largely on the secondary criteria. These criteria need clarification in that they present various objectives and it is unclear what relative priority these have. Furthermore, moving from broad objectives to specific operational criteria that can be used to make allocation decisions is a considerable step. Agreeing objectives and criteria is likely to be an extensive process, involving a wide range of stakeholders.

5.2.2 Beauty contests

153. We also considered an administrative option where competing demands could be traded off broadly in a so-called “beauty contest” to allocate shares of the new capacity. This would be carried out in a first stage where business cases submitted by airlines would be assessed. A richer base of information would be available to the coordinator than at present in order to try to achieve a more efficient allocation of slots.

154. The detailed coordination process of allocating specific slot timings to airlines would then be undertaken by the coordinator in a second stage. Having allocated shares of capacity within a number of categories, the total number of slot requests would not exceed the number of available slots. Hence this second stage process would be similar in nature to how grandfathered slots including change requests are coordinated at present.

155. In principle, both these mechanisms suffer from similar problems to maintaining the status quo. Whilst removal of the new entrant rule would reduce the scope for gross inefficiencies in the primary allocation, lack of information about willingness to pay remains a fundamental limitation on achieving efficient allocation. There is still a risk of speculative applications and the risk of windfall gains.

5.3 Set prices

156. The administrative system could be amended with a set of administratively set prices to choke off some excess demand. The set prices would relieve the administrative system of at least some excess demand, reducing the
burden on the coordinator. The allocation would to some degree be based on willingness to pay for slots, potentially improving efficiency somewhat.

157. In advance of airlines applying for slots, the administrator of the process (which could be the coordinator or the airport operator) would set prices for different types of slot (e.g. peak and off-peak, or more detailed prices for example on an hourly basis) and airlines would request slots only if they were willing to pay the set price. The allocation of slots would be carried out in a similar manner to the current system. The level of excess demand would be reduced relative to the current system, increasing the scope for achieving an efficient allocation.

158. The prices would necessarily have to be set as conservative estimates of a market clearing price, in order not to restrict demand too much and leave potentially valuable capacity unallocated. In practice it would be difficult to set prices close to the market clearing level as the administrator of the process has little or no information about the value a slot can generate for an airline. There may be a few price benchmarks available from recent secondary market transactions, but these are likely to be noisy given the thinness of the secondary market. Most importantly, such benchmarks are going to be of little relevance when there is a significant increase in supply. If prices were set below market clearing level, the coordinator would still be left with some difficult trade-offs to make between competing demands.

159. An industry stakeholder proposed that the price could be set over two or more iterations, allowing for some trial and error. The administrator would then first announce a set of prices on the basis of which airlines would initially request slots. If demand was in excess or below supply for some categories of slots, the prices would be revised and airlines invited to restate demand at the new set of prices. In practice, this proposal would be very similar to a simple clock auction as suggested below (or a so-called Dutch auction in the case of falling prices) designed to aid price discovery whilst keeping bidding simple. To avoid bidders acting strategically within this process, the administrator would have to specify rules about how bidders may revise demands, similar to the activity rules of an auction.

160. In principle, set prices is quite different to an auction in that an auction creates competition amongst airlines and by doing so reveals information about their valuations. Therefore, the set prices proposal suffers from similar informational limitations to administrative processes.

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25 We could at least be sure that the willingness to pay of those awarded slots exceeded the set price, though there would be no guarantee that slots were awarded to airlines with the greatest willingness to pay where more than one application was willing to pay the set price.
5.4 Auctions and hybrid options

161. Previous studies of the introduction of market mechanisms in slot allocation have suggested the most economically efficient outcome could be achieved by the use of Simultaneous Multiple Round Auctions (SMRA) of various types.\(^\text{26}\) In a SMRA, participants bid simultaneously for different lots. The auction proceeds over several rounds and after each round current winning prices for the different lots are announced. Bidders can change the lot or combination of lots they are bidding for as relative prices develop. The auction closes when there is no more bidding activity and final prices and winners are announced. The benefit of this type of auction is that it can allow bidders to respond to relative prices of different lots as they develop to achieve a highly efficient outcome.

5.4.1 Combinatorial auctions

162. We have considered a combinatorial SMRA that allows bidders to bid for portfolios of slots and to pursue substitute portfolios without the risk of ending up with fragmented outcomes. Bidders would make financial bids for slots (defined fairly precisely, for example as 15 time windows) or packages of slots subject to a set of nominated usage factors. At the end of each round, provisionally winning bids would be determined and current prices established for each slot, reflecting the provisional winning bids. The auction would proceed in rounds, with the bidders bidding up prices round-by-round until there was no further bidding activity.

163. From a practical perspective however, such an auction may become quite complex to implement (although entirely possible given sufficient care in development) and potentially complex for bidders to participate in. There may, therefore, be some benefit in trying to simplify the design, although such simplifications may sacrifice some of the potential efficiency gains related to the introduction of market mechanisms.

5.4.2 Clock auctions in a hybrid approach

164. One way of simplifying the process would be to solve the issue of trading off competing demands in a first step where shares of different types of capacity are allocated in a so-called ‘clock auction’ before undertaking the detailed scheduling coordination in a second step. A clock auction is a variant of the SMRA, used for selling multiple, identical lots. In this format, the auctioneer announces a price at the start of each round and bidders

respond how many lots they want at that price. There is a common price for identical lots that increases in each round until aggregate bidder demand falls to a level where it matches supply. This format allows price discovery whilst bidders simply state desired quantities.

165. We suggested that slots could be grouped into categories of ‘scheduling rights’, defined by broad time windows, to create a limited number of categories of multiple identical lots for the clock auction. The auctioneer would announce a price per scheduling right for each category ahead of each round. Bidders then state how many scheduling rights they wish to buy at that price. At the end of the round, the auctioneer aggregates demand at those prices across bidders. If demand exceeds the number of available scheduling rights in one or more categories, then the auctioneer increases the price per scheduling right by an increment in the following round. Bidders can then reduce demand in each category and the auction continues in this manner until demand equals supply for all categories.

166. A scheduling right would give the holder the right to request a specific slot time (within the given categories that they hold scheduling rights for) in the second stage detailed scheduling. In the second stage process, detailed coordination could be resolved in an administrative process by the coordinator. Having allocated the same number of scheduling rights as there are slots in each category, the total number of slot requests would not exceed the number of available slots and the administrative allocation process would be similar in nature to how grandfathered slots and change requests are coordinated at present. Although the coordinator may have to make a choice between competing applications for specific timings, the process would be eased by overall demand having been reduced to match overall supply within each category of scheduling rights. This type of process should also be relatively easy to integrate with the existing coordination process for grandfathered slots and the IATA deadlines.

5.5 Feasible options

167. There are strong arguments on the grounds of practicality for the use of auctions to permit price discovery, understand the value of airport slots and design an efficient allocation of new capacity. Only auction processes solve the fundamental problem of eliciting and aggregating information about how much potential users value slots. Whilst using administratively set prices is clearly a simple solution, the information required to determine the appropriate price level is unavailable.

168. Most stakeholders considered a combinatorial SMRA a complex option and thought that it would be burdensome for participants, especially for one-off allocations of new capacity.

169. Based on the feedback from industry stakeholders, we did not identify any significant reasons for a two-stage process with an initial auction of scheduling rights to be infeasible. From a practical point of view, a two-stage hybrid process combining a relatively simple auction with the tried and
tested administrative system for detailed coordination would be attractive compared to a more sophisticated combinatorial auction. It would be fairly straightforward to introduce such a system in a manner that integrated with current coordination practices. In Section 7, we address the practical details related to a two-stage hybrid process which were raised in our discussions with stakeholders.

170. A number of stakeholders pointed to the desirability of maintaining an administrative system. Many agreed that reform of the new entrant rule is called for and that this would put more pressure on the secondary criteria used for administrative allocation although there was some disagreement over how difficult it would be to agree a set of objective criteria for allocation.

171. The proposal of a more flexible approach based on assessment of business cases, eliminating the need for specific criteria, was rejected as unworkable and undesirable. We have therefore taken the administrative process without the new entrant rule forward as the base case administrative process to compare the use of market mechanisms against.

172. In Section 6 we discuss a process for amending the current administrative system by removing the new entrant rule and improving the secondary criteria for allocation.

5.5.1 Timing and compatibility with IATA scheduling

173. The IATA scheduling round currently imposes a firm deadline by which any particular allocation process must be completed. In terms of allocating new capacity, there is a potentially quite large time window for the allocation process, from the time when the amount of available capacity becomes known to the IATA deadlines for the season where the first phase of capacity becomes operational. The time frame for allocation of new capacity is therefore longer than the current process for allocation of pool slots.

174. Both administrative and market mechanisms have the potential to complete allocation of new capacity by a firm backstop date. However, not all the mechanisms we considered perform equally well in this regard and sometimes compromises are necessary to achieve a timely completion.

175. Legal challenge of the outcome of the allocation process is a possible source of delay, even where the allocation process itself has firm legal footing. In particular, administrative mechanisms run some risks of challenge from losers as these both involve an element of subjectivity and judgement (whether in developing a set of criteria or applying them). Losers have little to lose and much to gain from challenging the process. Administratively set prices would perform much better in this regard, as payments would reduce incentives for losers to appeal given that they would have to pay for a slot if they were successful in their appeal.
176. Auction mechanisms for slots should ideally involve open, multiple round processes rather than one-shot sealed bids. This may be a problem for a combinatorial auction of detailed slot timings, which have no defined finishing time. Provisions can be made for a last and final round to terminate the auction by a fixed time, but this potentially compromises some of the efficiency benefits of using an open auction.

177. This is not a particular problem for the two-stage hybrid approach, as scheduling rights can be auctioned as soon as it can be predicted how much new capacity is likely to become available. We understand that this might be up to a year in advance of the capacity becoming operational. Detailed slot timing would be assigned along with the existing pool slots. The relatively simple auction format should allow bidding to complete quickly. We discuss this further in Section 7.4 and show an illustrative timetable of how a two-stage hybrid approach can be integrated with the IATA scheduling process.

5.5.2 Implications for bilateral agreements

178. There has been a perceived problem that negotiations concerning bilateral capacity have been frustrated by lack of corresponding access to slots at congested airports. Lack of access to slots in the UK may make bilateral agreements difficult to achieve and prevent UK airlines from operating on these routes. We note as a starting point that the launch of a significant amount of new capacity should ease the capacity constraints and improvement access to slots to support such bilateral agreements.

179. Often, foreign airlines operating under a bilateral agreement will provide a low frequency point-to-point service and so can seek slots under the new entrant rule. This is the typical model for a bilateral agreement with developing countries. Therefore, access for foreign airlines to slots in a one-off allocation of a significant amount of new capacity could be affected either by the new entrant rule not applying to new capacity, or by foreign airlines paying where they previously did not.

180. Either measure does not automatically preclude foreign airlines from gaining slots to operate services under new bilateral agreements. However, they would remove any perceived preferential treatment that foreign airlines operating under bilateral agreements received in terms of accessing slots. They would need to compete for slots alongside other carriers operating in liberalised markets.

181. To the extent that a foreign airline operated at a scale or frequency not qualifying under the new entrant rule, it might find it easier to access slots in a market based allocation system provided that it was prepared to pay more than alternative users. Therefore, the primary concern is whether there is any market failure that would result from small foreign airlines operating under bilateral agreements having to compete for slots. If there were, that might justify tipping the playing field in their favour.
There are a number of possible reasons for such intervention to be justified in very specific cases:

- Fostering links with a particular country might be explicit UK public policy goal for political or macro-economic reasons. This might justify granting the foreign airline access to slots at UK airports on preferential terms. Similarly, there may be a concern that foreign airlines in some developing countries might be unable to afford to buy slots. Preferential access to slots might be granted to aid economic development in the foreign country or for reasons of equity;

- The UK Government may be in a weak bargaining position relative to the foreign government in concluding a bilateral agreement if the benefit to concluding the agreement was much larger for the UK than for the foreign country. In this case, the foreign government may be able to credibly seek concessions or else refuse to agree to the bilateral agreement.

These may be valid reasons why it might be reasonable to discriminate in favour of a foreign airline in securing slots to support a bilateral agreement. However, they are all contingent reasons and do not imply that it is generally necessary to discriminate in favour of foreign airlines operating under bilaterals in slot allocation.

5.5.3 Business risks and investment incentives for airlines

At present, lack of ready access to slots even by airlines prepared to pay for them creates significant business risks, for example there is uncertainty about the potential to expand if successful. This problem remains in the administrative mechanisms we have considered. Whilst airlines can obtain some slots in the secondary market, it is questionable whether a large volume of slots could be obtained at highly congested airports.

In contrast, market based mechanisms provide for access to slots by those with sufficiently high value uses. Therefore, an important source of uncertainty for airlines is removed and they have much greater commercial flexibility.

It might be argued that the price paid for slots is unpredictable and increases risks for airlines. However, the price of slots would be determined by a competitive process and will reflect the profits that an efficient operator can expect to earn (including the costs of its capital base). Where competition in downstream air transport service markets is effective, the value of a slot will be low. Conversely, if slots are scarce and this restricts competition in downstream markets, then there may be excessive profits. These would be competed away in competition for slots. Therefore, the price of slots should primarily be a reflection of competitive conditions in downstream markets and excessive profits that would otherwise be earned.

Airlines have two rather different planning horizons which the slot allocation system should mesh with. In the long term, airlines need to make fleet size
decisions. The lead times on new aircraft are typically a number of years. In the short term, airlines need to set and market their schedules. These are typically decided close to the start of the relevant season. Therefore, requiring airlines to fix schedules significantly in advance of the start of the season would be a significant change and be likely to create planning problems.

188. In general, market based mechanisms can provide greater certainty for long-term planning decisions. For example, decisions to purchase new aircraft are likely to be less risky if there are predictable mechanisms for obtaining slots in the future, albeit at a price. Conversely, it may be difficult to guarantee access to slots for even high value uses with an administrative system.

189. Similar considerations apply to short-run setting of schedules. Market-based mechanisms allow airlines to secure the times that they want, at a cost. In both of these auction mechanisms, it would be clear to airlines what price premium would be required to obtain specific timings, compared with being willing to accept a range of alternative timings.

190. The two-stage, hybrid approach has the interesting feature that it could allow scheduling rights to be sold once it was clear what amount of new capacity would become available on a certain future date. This could be significantly ahead of the relevant season. Having secured scheduling rights, airlines could then make specific requests for particular slots close to the start of the season (as at present) once their schedule was more clearly known. In the interim period, scheduling rights could be tradable.

191. This would seem to offer reasonable certainty to airlines both over the long-term (knowing that slots will be available to match aircraft stock) and the short-term (as timing would not need to be set until schedules are known). However, whilst some stakeholders expressed support for this, the airlines we spoke to did not generally consider that this was a significant advantage as fleet investment decisions were not connected to specific detailed schedules.

192. While it might be the case that existing airlines operating with a large portfolio of slots and aircraft might not benefit significantly from the extra certainty that being able to acquire new capacity early would bring, this is unlikely to be the case for new entrants. We would expect there to be significant benefits for both new entrants and smaller airlines seeking to expand from making the situation with regard to access to new capacity known as soon as possible, even if detailed slot timings were decided later.

5.5.4 Regional transport objectives

193. A slot allocation mechanism should be able to allow for other public policy objectives to be achieved, most importantly environmental objectives and regional transport objectives. We have already discussed the potential
interdependence of uncorrected noise and pollution externalities and the slot allocation system in Section 3.1.2.

194. In general, all of the mechanisms we have considered would allow the use of Public Service Obligations (PSOs) to achieve policy objectives such as the protection of regional air access to London. However, the market based mechanisms are generally more flexible and allow other policy objectives to be pursued whilst minimising economic distortions. It is possible that Regional Development Agencies could buy slots rather than apply for a PSO in this case. We note that the impact of a market based primary allocation on regional access to London might not be that different to the impact of secondary trading.

195. All of the administrative systems would allow PSOs to be imposed through capacity reservations. However, this would not necessarily allow a PSO to be met with minimal distortion of other services, as it is not clear what the relative value of different slots might be under these systems. If a PSO could be met through a broad range of slot timings, with a market based approach the costs of achieving the PSO in different ways can be observed. However, this cannot be observed with administrative allocation and it is not transparent what the opportunity cost of imposing the PSO is.
6 Administrative allocation

**Summary**

- Many stakeholders pointed to the desirability of retaining an administrative allocation system.
- We have, therefore, taken a reformed version of the current system forward as a base case.
- In addition to removing the new entrant rule for new capacity, the reforms would involve strengthening and clarification of the criteria for allocation.
- We believe that, in practice, it would be difficult to agree a set of workable criteria for the co-ordinator to use that were both simple and objective, yet sufficiently flexible to achieve appropriate public policy objectives.
- Regardless of reform, we believe an administrative system has limited scope to improve efficiency due to certain fundamental limitations.

196. The current administrative system is effective in allocating slots arising from new capacity in an operationally feasible manner. It achieves a high level of utilisation of airport capacity. However, because it is unable to take account of the relative value that airlines place on slots, it does not produce economically efficient outcomes, i.e. it is not necessarily those airlines whose use of the slots can generate most economic welfare that have access to slots.

6.1 Impact of removing the new entrant rule

197. In its current form, the new entrant rule stands out as an impediment to achieving an efficient allocation in the event that a significant amount of new capacity had to be allocated at a congested airport. It may create a restriction of competition in downstream markets to the detriment of consumers.

198. Whilst we have not considered whether the new entrant rule should be removed for the allocation of pool slots ahead of every season, removal of the new entrant rule is common to all the alternative mechanisms we considered for allocating a significant amount of new capacity. However whilst removal of the new entrant rule increases the scope for achieving an efficient allocation, in practice it would lead to greater demands being placed
on the administrative system as there are more choices to be made about who gets what.

199. Under the current administrative process, airlines apply for specific slot times and the coordinator assesses aggregated demand against capacity on an hour-by-hour and day-by-day basis. With a significant amount of capacity becoming available, applicants have an incentive to apply for slots within every hour of every day because that would improve chances of being rewarded with slots, which could potentially be sold through the secondary market. The opportunity for windfall gains presented by the secondary market produces strong incentives for speculative applications. With the new entrant rule gone, the field of candidates for every slot could be wide.

6.2 Revising the allocation criteria

200. The criteria for prioritising slot applications within the current system may vary from airport to airport and between Member States. The criteria currently used at fully coordinated airports in the UK\(^2^7\) divide into two types. First, a number of criteria of a practical, operational nature, which seem aimed at maximising usage of the available capacity:

- effective period of operation;
- frequency of operation;
- world-wide scheduling constraints e.g. curfews; and
- local guidelines.

Secondly, criteria which seem designed to encourage the airport coordinator to consider broader issues such as competition and economic efficiency:

- size and type of market;
- competition; and
- requirements of the travelling public.

201. The current criteria aimed at promoting efficiency and competition are not criteria that can be applied objectively by the coordinator. They are not tests that can be applied in a mechanical manner to resolve competing demands for slots. Rather, it might be more appropriate to describe the current secondary ‘criteria’ as broad objectives.

202. Many stakeholders pointed to the desirability of maintaining an administrative system with a number of objective criteria for prioritising applications. Although stakeholders agreed that it would be a challenge to

\(^{27}\) ACL, “UK slot allocation process and criteria”
agree a set of revised criteria, there were different views as to whether this would be feasible. One option for the Slot Regulations would be to set broad principles for slot allocation, such as:

- economically efficient use;
- promotion of competition;
- transparency and non-discriminatory access.

Member States could then be left to implement these principles as considered appropriate. Ultimately these principles would need to be turned into simple rules that could be applied in an objective manner by the coordinator.

203. There are a number of challenges a revision of the secondary criteria would need to overcome:

- First, to define an appropriate set of stakeholders to include in the process of revising the criteria. The airport operator, the Scheduling Committee for the airport in question and the OFT or the CAA are natural candidates but there may be a number of additional stakeholders and interest groups wanting to participate.

- Second, to agree on the overall objectives for allocation. Different stakeholders will inevitably have different interests, which in turn may lead to strong incentives for lobbying. A broad objective of economic efficiency would seem in the public interest, but this is difficult to implement in administrative processes with limited information about the value that airlines place on slots. In practice, we might well end up with multiple objectives and the need to weight these appropriately.

- Third, the agreed objectives would need to be translated into criteria based on observable factors such as long-haul vs. short-haul routes, aircraft-size and frequency of operation etc. This would allow the coordinator to take a rule-based approach to allocation.

204. A stakeholder proposed that prioritisation of objectives could be agreed by pair-wise comparison of different objectives for slot allocation. The process would first identify all relevant objectives and then assess the relative importance of each objective against every other objective to create an overall ranking. For each objective, specific criteria that represented the objective would then have to be agreed so that each competing request could be tested against the objectives. Once the criteria were agreed, the process would be implemented by inputting the data resulting from the evaluation of each competing request against the criteria into specialist software to create an overall ranking of applications in line with the prioritised objectives.

205. It was suggested by a stakeholder within the Industry Forum that UK industry stakeholders take the initiative to develop a set of workable criteria for a revised administrative system at London Heathrow to illustrate that broad agreement to a set of objective criteria could be met. We understand
that a group of UK industry stakeholders have been examining the potential for developing and agreeing a set of revised criteria for administrative allocation and intend to report progress on this work to the UK Government later this year.
7 Two-stage hybrid allocation process

Summary

• We have developed the two-stage hybrid approach further in response to industry feedback on its feasibility.

• Scheduling rights could be defined by one-hour time windows for departure or arrival.

• This approach makes the auction format slightly more complex than a system with broader timer windows, but reduces risk for airlines and the complexity for the coordinator.

• The two-stage hybrid approach integrates well with the current IATA deadlines for scheduling and does not present significant challenges for coordination with the other end of the route compared with an administrative system.

• Whilst the two-stage hybrid approach is relevant to different airport situations, the precise details can only be finalised in the context of a specific capacity scenario.

206. As discussed in Section 5, the two-stage hybrid allocation process emerged from the first stage of this project as the leading contender for a market based approach. Our discussions with airlines, airport operators and the coordinator about the feasibility of the various alternative allocation mechanisms did not reveal any issues suggesting that a two-stage allocation process would be unworkable. Whilst a number of industry stakeholders did not agree with the use of auctions as a general principle, they nonetheless agreed that a two-stage process was a feasible approach to explore further.

207. Our initial version of the first stage auction, as discussed with industry stakeholders and reported in the interim report, presented a clock auction of so-called ‘scheduling rights’. It was put to us that 3-4 hour time windows defining lots we proposed were too broad for airlines to value them and that lots would have to distinguish between arrivals and departures for the airport operator to be able to state capacity with a reasonable degree of accuracy. In this section we address how these points could be addressed and the practical implication this would have on the overall mechanism.
7.1 Defining lots

208. It would not be appropriate to have a single, undifferentiated scheduling right, as there is clearly a difference between peak and less valuable off-peak slots. On the other hand, slots that are close in time are likely to be substitutes, so it should be possible to group individual slot timings into categories.

7.1.1 Feedback on broad time windows

209. Our initial proposal was to group available slots into five broad groupings of scheduling rights throughout the day defined by 3-4 hour time windows, for example as depicted in Table 5 below:

<table>
<thead>
<tr>
<th>Category</th>
<th>Time window</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>06:00-09:00</td>
</tr>
<tr>
<td>B</td>
<td>09:00-12:00</td>
</tr>
<tr>
<td>C</td>
<td>12:00-16:00</td>
</tr>
<tr>
<td>D</td>
<td>16:00-20:00</td>
</tr>
<tr>
<td>E</td>
<td>20:00-23:00</td>
</tr>
</tbody>
</table>

Based on our understanding that demand (and hence slot prices) at highly congested airports does not vary greatly by day of the week, we had proposed that it would not be necessary to divide categories further according to day of the week. Applications for slot timings in the second stage would spread naturally across the week.

210. It is these broad categories that enable the relatively simple format offered by the clock auction. Whereas for example, the various early morning slots in Category A may be close substitutes, an early morning slot in Category A is not a substitute for a late morning slot in Category B or an afternoon slot in Category C. The auctioneer could therefore reasonably ask bidders how many slots they wanted within these categories at given prices and as prices were gradually increased round by round wait until demand had been scaled back to equal supply in each category. The activity rules required for the auction can be very simple when there is not much need for bidders to switch between categories.

211. Some airlines told us that categories defined by 3-4 hour time windows were “too broad”. We take this to mean that the slots within these categories are not close enough substitutes that airlines can attach a value to a scheduling right defined by a 3-4 hour time window. If scheduling rights within a 3-4 hour time window are of significantly different value depending on the exact timing to be allocated in the second stage, bidding for a broadly defined
Two-stage hybrid allocation process

Scheduling right would entail some financial risk for airlines. It is worth noting however that for the broad categories to work it is not necessary that every individual airline attaches the same value to any slot within the category as long as the secondary market (i.e. a sufficient number of airlines) values slots within a category similarly. If a particular airline won a scheduling right in the first round auction but did not get the exact slot timing required in the second stage, it would be able to sell the slot in the secondary market.

212. If demand is not evenly spread within these time windows, the coordinator may still have a number of issues to resolve by administrative means in the second stage. Whilst the broad time windows enable a simple auction process, this would be achieved by shifting some complexity onto the coordinator and financial risk onto the airlines.

7.1.2 Priorities

213. A stakeholder also proposed that scheduling rights could be defined according to priorities within the coordination process rather than time windows. Capacity would then be divided up into layers of priority, e.g. Priority 1, Priority 2, Priority 3, and Priority 4, defining whose slot requests would be met first in the subsequent administrative coordination process. In the second stage, where specific slot timings were to be allocated, there would be the same number of priorities held as there were slots available. Holders of Priority 1 tickets would get to make their specific slot request first and only once these slot requests had been fitted into the system would the specific slot requests of Priority 2 tickets be considered. Once Priority 2 requests were allocated, Priority 3 tickets would be considered, etc. Although there may still be more requests for specific timings, the priorities would ease the overall coordination process by defining a hierarchy of slot requests.

214. There are various alternatives for how such a process may work. Two distinct options are:

- a simultaneous auction of all priorities, having previously stated exactly how the second stage coordination would work; or
- a sequential process, with scheduling rights in the highest priority class being allocated slot times before the next priority class is auctioned.

215. In a simultaneous auction of all categories of priority, the value of a Priority 1 scheduling right would depend on which slot time the airline was allocated in the second stage coordination process. However, the slot time a scheduling right holder could expect to achieve would depend on which slot times other scheduling right holders would request. Hence the value of a
Two-stage hybrid allocation process

scheduling right to an airline would depend on who else wins scheduling rights and which routes they propose to use them for.\textsuperscript{28} The market may also struggle to derive a relative value of different categories of priorities. If demand at a highly congested airport such as London Heathrow is naturally spread out across the day, an airline wanting for example a 09:00 slot will find it difficult to know whether it is more likely to get this slot on a Priority 1 or Priority 2 scheduling right. In summary, we believe it would be difficult for airlines to value scheduling rights defined by priorities.

216. A sequential process has the further disadvantage that bidders would have to decide how many Priority 1 scheduling rights they want to buy without knowing the relative price of Priority 1 to Priority 2 scheduling rights. This erodes some scope for an efficient allocation as the key benefit of a market based allocation. Where sequential auctions have been used, they have typically led to rather inefficient outcomes, as they do not allow bidders to substitute between lots in an informed manner.\textsuperscript{29}

217. We are also concerned that if scheduling rights are defined by priorities, and the slot an airline is allocated therefore depends on what other winners request, then bidders may argue that bidding in the auction would necessarily have to be fully transparent, i.e. that information about bidder identities and number of scheduling rights requested is published after each round. However, as we will discuss in Section 8, we believe that in some cases it might be beneficial to restrict transparency for competition reasons.

7.1.3 Narrow time windows

218. As a revised proposal, scheduling rights could be defined by narrower time windows, for example defined by one hour time windows during morning and evening peak and two hour time windows during the midday off-peak hours and separated into departures and arrivals. This is presented in overview form in Table 6 below:

\textsuperscript{28} This is a significant impediment to secondary trade of priority rights, as different parties would have private information about the potential value of a priority right, which would depend on what requests were ultimately made for slot timings. Therefore, we could have a ‘lemon’ problem. For example, a seller of a Priority 2 right might be selling as it knows that it will use other Priority 1 rights it holds to make requests for slots that make Priority 2 rights unattractive. A potential buyer might consequently be wary.

\textsuperscript{29} For example, the Swiss government used such a sequential auction for wireless local loop spectrum. Largely identical licences sold for very different prices and there were large differences in the competitiveness of different auctions.
Two-stage hybrid allocation process

Table 6: Example scheduling rights – narrow time windows

<table>
<thead>
<tr>
<th>Time window</th>
<th>Type of movement</th>
</tr>
</thead>
<tbody>
<tr>
<td>05:00-06:00</td>
<td>Departure</td>
</tr>
<tr>
<td></td>
<td>Arrival</td>
</tr>
<tr>
<td>06:00-07:00</td>
<td>Departure</td>
</tr>
<tr>
<td></td>
<td>Arrival</td>
</tr>
<tr>
<td>07:00-08:00</td>
<td>Departure</td>
</tr>
<tr>
<td></td>
<td>Arrival</td>
</tr>
<tr>
<td>08:00-09:00</td>
<td>Departure</td>
</tr>
<tr>
<td></td>
<td>Arrival</td>
</tr>
<tr>
<td>09:00-10:00</td>
<td>Departure</td>
</tr>
<tr>
<td></td>
<td>Arrival</td>
</tr>
<tr>
<td>10:00-11:00</td>
<td>Departure</td>
</tr>
<tr>
<td></td>
<td>Arrival</td>
</tr>
<tr>
<td>11:00-13:00</td>
<td>Departure</td>
</tr>
<tr>
<td></td>
<td>Arrival</td>
</tr>
<tr>
<td>13:00-15:00</td>
<td>Departure</td>
</tr>
<tr>
<td></td>
<td>Arrival</td>
</tr>
<tr>
<td>15:00-17:00</td>
<td>Departure</td>
</tr>
<tr>
<td></td>
<td>Arrival</td>
</tr>
<tr>
<td>17:00-18:00</td>
<td>Departure</td>
</tr>
<tr>
<td></td>
<td>Arrival</td>
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<td>18:00-19:00</td>
<td>Departure</td>
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<tr>
<td></td>
<td>Arrival</td>
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<tr>
<td>19:00-20:00</td>
<td>Departure</td>
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<td>Arrival</td>
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<td>20:00-21:00</td>
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<td>Arrival</td>
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<td>21:00-23:00</td>
<td>Departure</td>
</tr>
<tr>
<td></td>
<td>Arrival</td>
</tr>
</tbody>
</table>

If demand was found to vary across the days of the week the categories could be further subdivided, for example into Monday-Friday and Saturday-Sunday. The definition of scheduling rights may have to vary from airport to airport, depending on the structure of demand. We would expect the organisation who designs the auction to consult with prospective bidders about the packaging of slots when designing the auction.

219. The many more categories of scheduling rights (28 in this example as opposed to five in the example with broad time windows) mean that the administrative coordination in the second stage would be more straightforward. In fact, this would be strikingly similar to the coordination currently undertaken for existing slots where capacity is stated by the airport operator and air traffic control as hourly scheduling limits and airlines have grandfathered rights to specific timings to which they can request changes within the hour. Airlines also face less risk bidding for scheduling rights as the narrower time windows gives them more certainty about the actual slot timing that a scheduling right will translate into, particularly for potentially valuable peak slots.

220. However, the auction necessarily becomes less simple. This is because with more categories there are more slots within different categories of scheduling rights that are likely to be substitutes (e.g. 06:50 and 07:05 departures are in different categories but likely to be close substitutes). As a result, there is going to be more switching between categories as relative prices develop. This poses a challenge for a clock auction because it
increases the risk of sudden demand drops or so-called overshooting. The term overshooting refers to a situation where there is excess demand in one round and prices are therefore increased but at that price, demand drops below supply leaving the auctioneer with a number of unsold scheduling rights in that category.

221. More categories call for a more sophisticated set of activity rules for how bidders can bid in each round in order to maintain their eligibility to make bids in future rounds. With large categories, a simple activity rule can be applied, e.g. that the number of scheduling rights bid for in any one round can only be the same or less than in the previous round. However, with more categories such activity rules are not sufficient to prevent bidders from acting strategically by placing their demand on cheaper off peak categories only to switch to the desired peak slots towards the end.

222. There are various options for how more sophisticated activity rules could be defined. One option is to use a ‘revealed preference’ activity rule as suggested by Ausubel, Cramton and Milgrom\(^\text{30}\) whereby the total cost of a bid can only go up from round to round, but where switching between different categories of slot is possible. A simpler alternative is to assign points to different categories of slots and require that the total number of points bid does not increase. This latter system has often been used, but raises the tricky question of how to set the points value of different categories of slot.

223. As aforementioned, it is possible that the auction will ‘overshoot’, i.e. demand for scheduling rights in some categories may be suddenly drop to less than supply as price is increased from one round to the next. This phenomenon has been observed in some clock auctions, so it is not just a theoretical possibility. There are number of options for dealing with the possibility of unsold slots that could arise with the simplest version of the clock auction\(^\text{31}\):

- leave the unsold capacity with the coordinator to allocate on a first-come, first-served basis at a price linked to those achieved in the auction;
- assign the capacity to bidders in the clock auction on the basis of bids they made at the point that they dropped eligibility by building in the option for bidders to submit ‘last and final’ offers; or

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\(^{31}\) Note that simply reducing the price is not an option once overshooting has occurred, as if bidders anticipate that the auctioneer will behave in this way, they will have perverse incentives.
Two-stage hybrid allocation process

- include a so-called ‘proxy’ phase after the auction.

Which of these options is more appropriate will require careful analysis under the specific circumstances and would require experimental testing.

7.2 Statement of supply

7.2.1 New capacity scenarios

224. At this stage, the amount and nature of new capacity that might become available at congested airports is unknown. In the UK, new capacity might be derived from the potential introduction of mixed mode operations at London Heathrow or the construction of an additional runway at London Heathrow or London Stansted.

225. If a third runway was to be constructed at London Heathrow this is likely to be a short runway, suitable for smaller, short-haul aircraft only. In this scenario, it may be more efficient to relocate some short haul services from the existing two runways to the new runway (subject to terminal constraints) and there may be a number of ways of doing this:

- allocating slots at a new short runway suitable for short haul services only; allowing airlines who operate short haul services on the existing longer runways to apply, relocate their existing operations to the short runway and sell their slots suitable for long haul services in the secondary market;

- in the case of an auction, allow holders of grandfathered slots on the existing longer runways to add their slots to the auction so the auctioneer would be selling these on behalf of airlines at the same time as these airlines would bid for short haul slots on the new runway; or

- reallocate short haul services from the existing runway to the new runway to the extent this was possible and then auction or allocate the capacity that had become free, some of which may be on the long runways and some of which may be on the short runway only.

226. It is also possible that environmental constraints rather than runway capacity would bind in the case of new capacity, and that the allocation mechanism would need to focus on noise and pollution limits. As discussed in Section 3.1.2, the UK currently addresses environmental constraints primarily through the use of quantitative limits and operating restrictions. These constraints would be taken into account when stating capacity available for allocation from which any allocation would start, whether administrative or market based.

227. Issues relating to the amount and nature of capacity can clearly only be resolved when the exact details of new capacity are available. The details of an allocation mechanism cannot be finalised until the exact type and amount of capacity and the constraints related to usage is known. Nevertheless, all
of these possibilities can be dealt with by variations of the procedures discussed here.

### 7.2.2 A generic capacity scenario

228. Consider a particular scenario to illustrate how the suggested auction format may look in practice: the provision of a new runway that can be operated in a mixed mode. This would provide various possible combinations of departures and arrivals subject to a total limit per hour. Figure 1 below shows an example in which the total scheduling limit for a new runway in a given hour is 49 movements subject to a maximum of 29 departures and 25 arrivals. Any combination within the boundary represented by the pairs of arrivals and departures can be scheduled.

*Figure 1: Example of an hourly scheduling limit*

229. Traditionally a simple clock auction has fixed supply within each category of lot. However, whilst the total number of slots per hour is fixed in this case, there are a number of possible combinations of arrivals and departures within that total. We could benefit from letting the market decide which of the possible combinations would attract the highest value. The auctioneer could solve this by running a simple calculation to determine the optimal mix of departures and arrivals after each round, based on the requested quantities in that round.

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32 Note the total number of slots per hour may vary according to aircraft size. The stated hourly capacity is based on an expected mix of large and small aircrafts and may be revised over time if the actual mix of actual users changes. However, we understand from the coordinator that this causes only relative minor variations in stated capacity, so we can ignore this issue for now.
7.3 Mechanics of the process

230. Having discussed how lots may be defined, this section summarises how the auction would proceed step by step. Before the auction, the auctioneer would announce the total number of scheduling rights available for each category defined by time and type of movement and a uniform reserve price per scheduling right for each category. The auction then proceeds as follows:

i) Prospective bidders submit prequalification applications as required and associated deposits.

ii) In each round of the auction, bidders submit bids for a number of scheduling rights in each category at the prevailing prices, subject to the activity rules. The bidders will be provided with software that helps them calculate the total cost of their bid and whether this is in accordance with the activity rules. The bids could also be submitted electronically.

iii) Subject to compliance with the activity rules on a round-by-round basis, bidders are free to shift their bids for scheduling rights in any amounts across categories in response to changes in relative prices.

iv) At the end of each round, the auctioneer determines whether aggregate demand across all bidders for scheduling rights exceeds available supply:

- If demand exceeds supply, then the price per scheduled right for that category will be increased in the next round. The increment per right is determined by the auctioneer;
- If demand is less than or equal to supply, then the price per scheduled right for that category will remain unchanged in the next round.

v) If there is a round in which demand for all scheduling rights for all categories is less than or equal to supply, then the auction will end. The remaining bidders will be allocated rights in each category at the prevailing prices.

vi) Implementation of an appropriate process to resolve overshooting, e.g. proxy phase or evaluation of last and final offers might be required, in which case the end of the auction might also involve certain procedures to allocate slots through the auction that would otherwise be unsold.

vii) Subsequently, holders of scheduling rights would submit requests for detailed timings according to the IATA deadlines in an administrative coordination process coinciding with coordination of grandfathered slots.
7.4 Time scales

231. Any auction of slots would have to fit into the IATA timetable for slot allocation, allowing airlines to plan schedules. Figure 2 below shows how an auction may be integrated with the IATA timetable for scheduling.

232. In this example, the first phase of new capacity would become available for the winter season. Assuming that the airport operator would be able to state capacity a year ahead of new capacity first becoming available for use, the airport operator would release the scheduling constraints for new capacity at the end of October 12 months before start of the season. The auction rules could then be finalised for publication within a couple of weeks providing exact details of lots and reserve prices for the first round. Bidders may then be asked to submit an application to pre-qualify for bidding and provide a specified deposit. In return, the auctioneer may offer bidder training packages or perhaps a seminar. The auction itself could probably be completed over three to four weeks, depending on the interval between rounds.

233. This leaves up to three months time before the IATA deadline for submission of scheduling requests for the coming winter season, in which time airlines can plan routes based on both existing and new capacity to which they have won the usage right. During this period, airlines could trade scheduling rights if their initial holding proved not to match requirements. Holders of scheduling rights would submit detailed timing requests within the given categories together with their scheduling requests according to historic usage. Following the coordination and going into the IATA conference, airlines can trade slots in the secondary market in the usual manner.

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33 We have discussed this assumption with an airport operator who agreed that was a reasonable assumption for a major release of capacity.
The two-stage approach facilitates allocation of capacity well in advance of the capacity becoming available for use by deferring detailed coordination for it to coincide with the existing coordination process. Although the industry stakeholders we spoke to did not see this as an advantage, this may prove helpful to new entrants and smaller airlines that may be less dependent on integrating new routes within an existing network but would benefit from the additional planning period. In particular, for an entrant knowing in advance of a season that it had access to slots might benefit it greatly in making complementary investments (such as aircraft leasing and marketing of services).

### 7.4.1 Seasons

Coordination of airport operations is undertaken twice a year according to deadlines set by IATA, ahead of the winter season commencing at the end of October and the summer season commencing at the end of March. As we
understand, demand at London Heathrow does not vary significantly from summer to winter whilst demand for slots at other busy airports such as London Gatwick, varies week by week throughout the year although not necessarily according to the defined limits of the seasons. For example, charter airlines may only require slots for 12-16 weeks of the summer season. Nonetheless, the process of coordination on a seasonal basis is ingrained in the current system and a market based allocation of slots needs to fit within this process.

236. In the case of an airport where slots are predominantly demanded for year-round services, the separate auctioning of capacity for the winter and summer seasons would leave bidders vulnerable to a significant aggregation risk, i.e. the risk that a bidder wanting to secure slots for a year-round service may fail to win the same scheduling rights for the winter and the summer season. This risk could be eliminated by using a single clock auction for both seasons. However, a simpler solution might be to sell only year-round scheduling rights that entitled holders to a slot in each season, given that most airlines will want year-round rights in any case.

237. Therefore, we would propose that new scheduling rights be auctioned for year-round services with coordination undertaken on a seasonal basis in line with the IATA timescales. Coordination for the very first season would be undertaken as described in the example in Figure 2 above (where the first season is winter for the sake of the example). Coordination for the first summer season after the new capacity has become available would be done alongside the coordination of historic slots for the summer season in the exact same manner, with airlines submitting scheduling request subject to their scheduling rights. From then onwards, airlines can carry over the specific slot times allocated for the winter and summer seasons respectively precisely as they do under the current system. Airlines who are not seeking to operate both summer or winter seasons could lease part of their slot to another airline. This facilitates a simple auction, eliminates aggregation risk and ensures compliance with the IATA process.

238. Airports with a significant amount of charter traffic and more seasonality in demand patterns may need to consider whether it is appropriate to allocate year-round capacity or whether to auction capacity for the summer season and winter seasons separately, or perhaps even auctioning only the most congested season.

7.4.2 Coordination with the other end of a route

239. The issue of coordination of the slot allocation with the other end of a route was raised by several industry stakeholders. Some stakeholders argued that this issue means market based allocation mechanisms cannot be applied to airport slots. However, a significant amount of new capacity becoming available at a congested UK airport would represent a step change; new capacity provides opportunities for new routes or additional frequency of operations on existing routes. If the other end of the route is an airport with spare capacity, airlines can acquire capacity to match the
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slots allocated to them at the congested UK airport. Hence this seems to constitute an issue only for airlines that want to operate routes to other congested airports.

240. Where airlines want to use the new capacity for services to another congested airport, there seems to be a coordination issue regardless of the allocation mechanism. Even within the current allocation system, airlines would have to apply for slots at both congested airports simultaneously subject to the IATA deadlines and would only know whether they had got a matching set of slots once the coordination process was completed at both airports. If the airline did not get matching slots, it could hand back the slots at both ends or swap or buy a matching slot at either end in the secondary market. The obvious difference with a market based system is that an airline would have to bid for and pay for a slot, without knowing whether it could get the required matching slot at the other end. However, if it failed to get a matching set of slots it could sell the slot it had bought in the auction in the secondary market, which reduces the perceived risk to a risk of not obtaining the same price in the secondary market as in the auction. In the unlikely event that there was a simultaneous release of a significant amount of new capacity at two congested airports in Europe, and both were to allocate capacity by auction, there may be some benefit in coordinating timings and approach.
8 Competition issues

Summary

• Introduction of market based slot allocation mechanism (both secondary trading and auctioning of new capacity) should promote competition.

• However, there could be a risk in some circumstances that slots might be concentrated to protect or strengthen market power.

• The need for intervention, as well as the appropriate measures to prevent such an outcome, would need to be assessed on a case-by-case basis.

• The use of auctions for slot allocation allows the use of a range of “softer” measures, such as restricted transparency in the auction, which are superior to “harder” measures, such as caps on overall slot holdings.

• It would be prudent to provide a firm legal basis for NCA review of auction format and rules by including such a provision in revised Slot Regulations.

241. The introduction of market based mechanisms, including both secondary trading and the use of auctions for primary allocation, has the potential to enhance competition amongst airlines. At present, difficulty in gaining access to slots may act as a barrier to entry or expansion. Airlines that boost demand for their services through lower prices or better quality service may not be able to secure additional slots. In turn, this acts as a disincentive for airlines to compete for customers by cutting prices or improving quality, impeding competition.

242. Although market mechanisms can clearly do nothing to alleviate the underlying scarcity of slots, they can ease barriers to expansion and entry by ensuring that those airlines who value slots more than others have opportunities to acquire slots. At present, one airline might have a potential use for a slot that can generate greater benefits for customers than another airline’s use, and so be prepared to pay more for that slot than the other airline, but have little certainty that it would be shown preference in award of the slot. Moving to systems such as secondary trading and auctions for primary allocation that permit slots to flow to higher value users can reduce barriers to expansion and entry even with a fixed supply of slots.
243. However, both secondary trading and auctions raise the possibility that new freedoms are used not to compete more intensively, but rather to impede competition through one airline trying to corner the market for slots at an airport. Clearly such possibilities are always present in any industry where there is a vital input in fixed supply that competitors compete to acquire. In fact, as we explain below, there may be less cause for concern in the case of airline competition, as the linkage between slot distribution and competition in providing air transport services may be rather indirect. Furthermore, competition law already provides significant powers to control such outcomes.

244. Nevertheless, concerns may remain that at some airports, slots might be concentrated to protect or strengthen market power. For example, a hub carrier with a large slot holding at a congested airport may have higher valuation of slots as a result of having market power in downstream markets derived from its large slot holding, and it may use this position to acquire new capacity in order to protect or extend its market power.

245. There are good reasons to attempt to limit the potential for acquiring slots to exercise market power by appropriate design of mechanisms for primary allocation and secondary trading. This holds true even though competition law provides an ultimate safeguard. First, competition law may be slow to apply and it may be appropriate to try to limit any detrimental effects on consumers through other means available. Second, competition in air transport services may not be effective even if there is no airline that is dominant in the sense of competition law. Therefore, there might be competition problems that modification of primary allocation or secondary trading mechanisms could improve that would fall below the usual threshold for intervention under competition law.

246. Given this, it is important to consider what safeguards can be built into primary allocation processes to ensure that competition is enhanced rather than impeded. Often it will not be necessary even to consider such safeguards, as competition amongst airlines may already be effective or slot allocation may have little immediate impact on the intensity of competition. However, it is appropriate to identify measures that could be adopted where there are potential problems. Given that the allocation of slots is closely controlled through the Slot Regulations (and its potential successor), clearly there is an opportunity to pursue policy objectives aimed at promotion of competition in parallel to competition law. As competition law remedies are always available, it is particularly important that interventions in the slot allocation process designed to improve competition in air transport services are proportionate.


## 8.1 Basis for intervention

247. The OFT and the CAA have prepared a joint paper on competition issues related to secondary trading of airport slots.\(^\text{34}\) Amongst other issues, this considers the basis for intervention to alleviate competition problems related to secondary trading and concludes that:

- merger control is unlikely to apply to slot trades;
- ex-post controls by application of Article 81\(^\text{35}\) and Article 82\(^\text{36}\) are likely to be ineffective in the context of slot trades because it is difficult to link slot holdings directly to competition problems in a particular downstream market; but
- in the UK, the OFT could use its power under the Enterprise Act 2002 to proactively conduct a market study or make a market investigation reference to the Competition Commission ahead of the introduction of formal secondary trading.\(^\text{37}\)

248. In principle, it should be easier to intervene to protect competition in the primary allocation of slots relating to new capacity than in secondary trading. There is no need to modify existing property or usage rights held by airlines retrospectively in order to intervene. If there are perceived impediments to achieving competition in the auction, for example because some bidders may hold incumbency advantages, the auction format and rules can be set as appropriate with a view to improving competition in downstream markets. Such measures can be employed for primary allocation in instances where there appears to be scope for improving the effectiveness of competition in downstream markets but it would be difficult to intervene on the basis of Article 81 or 82.

249. This is the approach taken by Ofcom (and its predecessors) when designing auctions for radio spectrum. For instance, consideration was given to the use of a so-called Anglo-Dutch hybrid auction for the award of the UK’s 3G mobile phone licences. This is an open auction followed by a sealed bid. The sealed bid element was considered to encourage competition in downstream markets as it might have been easy for all the incumbent 2G mobile phone operators to acquire licences in a fully open auction. In the end, this format was not adopted as it was possible to offer more licences than there were 2G mobile operators, but the considerations are well-

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\(^{34}\) “Competition issues associated with the trading of airport slots”, A paper prepared for DG TREN by the UK Office of Fair Trading and Civil Aviation Authority, June 2005.

\(^{35}\) Article 81 of the EC Treaty prohibits agreements, decision and concerted practices that restrict competition.

\(^{36}\) Article 82 of the EC Treaty prohibits the abuse of a dominant position.

\(^{37}\) At the time of writing, the OFT has just launched a market study into airports.
documented.\textsuperscript{38} Since then, Ofcom has used a sealed-bid auction specifically because of concerns that incumbent players might otherwise corner the available licences.\textsuperscript{39}

8.2 Assessing the need for intervention

250. Competition concerns related to slot holdings are ultimately derived from constraints on expansion at congested airports. Additional capacity should, therefore, be expected to ease any competition concerns at least to some extent. The primary allocation of a significant amount of new capacity is unlikely to cause the same level of concern about increasing concentration of slot holdings as would the introduction of secondary trading at a congested airport.

251. There are many downstream air transport markets which could potentially be affected by how slots are held at a congested airport. As pointed out in the OFT/CAA paper, case precedent suggests that every route (i.e. every combination of a point of origin and point of destination) could be seen as a separate market and that markets may be further subdivided by types of passengers, non-stop versus one-stop flights and particular airports within the origin or destination city.

252. The existence of many downstream markets for air transport services means that the linkage between the distribution of slots at a congested airport and downstream competition in any particular relevant market may be weak. It would be potentially quite difficult for an airline to foreclose competition in downstream markets through control of slots. For example, control of slots would not be a particularly useful strategy to blockade entry on a particular point-to-point route, as there are so many slots in total at an airport relative to the number needed to offer a service on one particular route.

253. This said, it is still possible that an airline that holds many slots at an airport may have some hubbing benefits, as it can offer its customers interconnecting flights between many combinations of arriving and departing locations. This is not itself a problem, as a hubbed system may have significant cost advantages over a collection of point-to-point services, ultimately leading to lower prices and more diverse services for customers. However, where this hubbed airline is in a position that is difficult for other airlines to challenge and compete with, these benefits may not be fully passed through to customers. Whether or not this occurs is highly case


specific. For example, an airport might support multiple hub-and-spoke airlines, directly competing. There may be other nearby hub airports that provide competing hub-and-spoke systems. Therefore, it is conceivable that even if an airline held the majority of slots at an airport, it might not be dominant if constrained by competition from airlines at other airports.

254. In summary, whilst some airlines may have an incentive to bid more than others for slots, this is not necessarily a problem. It may simply reflect the greater value that some airlines can generate from slots, even facing effective competition in downstream air transport service markets. Therefore, competition may be enhanced rather than impeded by slots flowing to those who value them most. Even bidding for slots to build a hub operation is not necessarily anticompetitive.

255. Therefore, there is no reason to expect the introduction of market mechanisms to create a tipping point where slots concentrate in the hands of dominant airlines. To date, experience from the de facto secondary market at London Heathrow shows that second tier airlines already present at Heathrow as well as new entrants can make a business case for acquiring slots. Competition problems may occur in specific circumstances rather than being a general feature of market mechanisms.

256. The need for intervention to promote or protect competition when allocating a significant amount of new capacity cannot be assessed in generic terms; a case-by-case approach is required. Whether competition protection measures are required would depend on a number of specific factors such as:

- the distribution and use of existing capacity;
- the amount and type of new capacity available to award;
- the scale of any expected further capacity releases in the future; and
- the availability of capacity at substitutable airports.

257. If analysis of the competitive conditions ahead of the allocation of a tranche of new capacity showed that an incumbent airline is likely to attach higher valuations to slots for anticompetitive reasons, the next step would be to develop objectives for intervention. If there were serious concerns about the downstream market structure, then an objective of simply promoting equal access to slots may not be sufficient, but rather the promotion of entry through the design of the allocation process may be necessary.

8.2.1 State aided airlines

258. Another potential source of competitive distortions is the existence of state-aided airlines. Such airlines might have access to capital at better than commercial rates in order to purchase slots at congested airports. This could inefficiently displace other airlines who could offer services more
valued by consumers or more operate more efficiently. This situation was raised as a fear by a UK airline.

259. Within the EU, distortion of competition due to state aid can be addressed through the existing rules on State Aid. Implicit or explicit subsidies to EU airlines from national Governments are prohibited subject to certain, very limited exceptions. Rigorous application of existing rules should be sufficient to remove distortions of competition amongst EU-based airlines.

260. Furthermore, any move to an opportunity cost based charging regime for slots (as would result from the use of auctions) within reformed Slot Regulations would make any implicit state aid to airlines more transparent. If there was excess demand for slots at an airport, any airline being granted slots for free would arguably be receiving slots at a subsidy, as the value of slots would be visible from prices established at other congested airports. This issue may require further legal analysis in the context of EU’s State Aid rules.

261. Therefore, the main concern with state aid is limited to nationally owned flag carriers based outside the EU. If extra-EU state aid is a significant problem, any allocation system might need to discriminate against such airlines if the problem is to be mitigated. Even with an administrative allocation system, some measure might be needed to ensure that state aided carriers from outside the EU could not acquire too many slots. Whilst it might be possible to do this in a less obvious and transparent manner within an administrative process, it is a problem for both administrative systems and market based systems.

262. Nevertheless, to the extent that administrative allocation systems do not produce efficient allocations that reflect the willingness of airlines to pay for slots, this could impede the ambitions of a state-aided airline to win slots. A reasonable concern is that with market based allocation methods (including both secondary trading and auctions) the high willingness to pay of a state-aided airline would lead to it winning slots inefficiently. However, this is a very poor argument for retaining an administrative allocation method, as this limits the ability of such a state-aided airline to acquire slots by introducing widespread inefficiencies in the allocation of slots; the remedy is disproportionate given the problem being addressed. A better solution would be to reserve powers to apply quantitative limits on slots held by foreign state aided carriers or surcharging their bids in the case of an auction.

263. Regardless of whether administrative or market based allocation methods are used, there may be practical limits in applying discriminatory measures against state aided carriers from outside the EU. In practice, reducing state aids may be a matter for negotiation between the EU and other states. Whether pressure can be brought to bear on the foreign flag carrier may depend on the fear of reprisals from the foreign government against EU carriers, for example by limiting access to its airports.
8.3 Potential measures

264. If there is need for intervention to promote competition, the appropriate measures will again be case specific depending on the severity of the potential problem. There are a number of different measures which can be adopted in the auction design, some of which we call “hard measures”. These types of measures guarantee a specific outcome or systematically discriminate against incumbents. These are often rather blunt instruments that may create unwanted side effects and be disproportionate to the problem sought rectified. The use of auctions would also allow the use of what we call “softer measures” to favour downstream competition. Such measures encourage entrants to participate and compete without explicitly discriminating against incumbents and whilst treating all bidders in a neutral and fair manner.

8.3.1 Hard measures

265. There are at least three types of measures:

• reservation of a proportion of capacity for new entrants in general or for specific routes on which competition is considered inadequate;

• measures that create a bias in favour of entrant bids in the auction; or

• restrictions on the number of peak slots any one airline is allowed to hold.

266. Reservation of capacity for new entrants or particular routes would require the term ‘new entrant’ to be explicitly defined or the routes which would qualify under such rules to be named. Any rule of this type requires definitions, but definitions are difficult to develop when the competition problems that the rules are intended to address cannot be fully anticipated in advance.

267. The general difficulty with new entrant provisions is that measures to encourage entry tend to restrict expansion. Once an entrant has won slots, it rapidly ceases to be an entrant and so does not enjoy any protections when expanding to compete with larger airlines. The nature of competition in air transport services is such that size does matter. It is difficult for a small carrier offering a low frequency point-to-point service to compete with a larger carrier offering high frequency services that might also be integrated into a wider network of interconnecting flights. Enabling smaller airlines to expand and compete with larger airlines is more important in terms of competition delivering benefits for consumers than is encouraging niche entry.

268. A further disadvantage of this type of rule is that restrictions on how such slots could be traded in the secondary market are required (as for example the two year restriction on trading of slots new entrants have been granted from the pool under the current slot regulations). Unless the restrictions on secondary trading were total restrictions, the mere existence of a secondary
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market would create the possibility of arbitrage generating incentives for speculative bidding and undermine the measure itself.

269. Another option is to employ measures that create a bias in favour of entrants and discriminate against incumbents, for example by giving bidder credits to entrants or handicapping incumbents by multiplying entrant bids by a factor larger than one. This type of approach has been used in US spectrum auctions, although radio spectrum may be a less relevant example because the relationship between licences and competition in downstream communications services market is much tighter than it is for slots and air transport services. This approach also requires an entrant to be defined and hence suffers from definitional problems too. Although there has been much debate amongst auction designers about whether bidding credits or bidder handicaps might even increase competition within an auction itself40, current views tend to argue against such an approach due to the difficulties in deciding the details of such systems and the dangers of fragmented outcomes.41

270. Where airports are publicly owned, as is the case for some European airports, or if airport slots were government property regardless of airport ownership, bidder credits or handicapping may be considered State Aid by virtue of its form even if it had the effect of increasing competition. This is probably sufficient to render such an approach unworkable by itself. It would also create some tension with the principle of non-discriminatory allocation of slots in the Slot Regulations.

271. A restriction on the number (or proportion) of slots, or peak slots that any one airline can hold, circumvents the problem of having to define a new entrant. This limit would apply to all airlines. It would not be undermined by secondary trading and is probably the most appropriate if any of these hard measures were to be employed. Therefore, this is a much preferable approach to discrimination amongst bidders. It would not run into any problems with State Aid rules or with discrimination, as all bidders would be treated similarly in application of any caps.

272. The main difficulty with caps on slot holdings is practical. It is not obvious how to set an appropriate limit as the linkages between slot distribution and competition in air transport services is indirect and difficult to forecast. The effectiveness of this type of measure may also be undermined by alliance partners having access to one another’s routes through code sharing agreements. Arms length relationships between different companies might

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be created with the sole purpose of undermining caps on slot holdings, so some notion of holdings being defined by access to slots, rather than simply ownership of slots would need to be developed. Nevertheless, caps may still be a valuable tool for airports with a single hub carrier unchallenged by competition at that airport or neighbour hubs.

8.3.2 Soft measures

273. Asymmetry between bidders can affect competition within an auction. Incumbent airlines with large slot holdings or airlines with hub base at the airport in question may be perceived as strong bidders whereas new entrant or smaller airlines would be perceived as weaker bidders. These differences between bidders are common knowledge and will affect how bidders bid.

274. Certain auction designs are more favourable to stronger bidders than others. In particular, open auction processes may favour stronger bidders as they can simply routinely overbid weaker bidders, firm in the knowledge that whatever a weak bidder is prepared to pay, a slot should be worth more to the stronger bidder. In contrast, such behaviour is more difficult in sealed bid processes. A further concern is that where the value of a slot may be uncertain to a bidder itself and related to what other bidders are prepared to pay, this disproportionately affects weaker bidders in open processes. This is a complex subject, so we would refer the interested reader to relevant literature.\(^{42}\) However, for our purposes the relevant point is that in certain circumstances some auction formats can exacerbate asymmetries between bidders, whereas other auction formats can limit the impact of asymmetries, giving weaker bidders a better chance.

275. In order to promote downstream competition, it is reasonable for the design of the allocation process to ensure weak players have a reasonable chance to compete for slots with stronger players. The standard way of addressing this problem is to use sealed bids, which encourages weaker bidders to participate by making it more difficult for the strong bidder to outbid the entrant. However, a simple sealed bid approach\(^{43}\) is not practical when auctioning a large amount of new airport capacity because of the uncertainty surrounding slot valuations. In this case, airport slots would have a significant common value element (i.e. common unknown factors affect different bidders’ value of a slot) and an open, multi round process would allow bidders to inform their valuations by the bids placed by other parties.

\(^{43}\) Some of these problems can be overcome using a combinatorial sealed bid auction.
Moreover, a sealed bid process also carries the risk of an inefficient outcome because the bidder with highest valuation of slots may nonetheless be tempted to bid lower than its valuation and lose out. In sealed bids, there is a much greater role for bidders’ assessments of other bidders to affect the outcome, so it is possible for the winner to be someone other than the party with the greatest willingness to pay. Therefore, there is always some tension between efficiency in the narrow sense of slots going to those prepared to pay most and promotion of competition in the sense of levelling the playing field between weak and strong bidders. Moving to a system that could produce significantly inefficient outcomes (as a simple sealed bid auction could) would not be a proportionate measure to address a mild concern about competition.

Fortunately there are quite a few aspects of auction processes that can be adjusted to balance concerns for efficiency with concerns for protection of competition. Therefore, it is possible to fine-tune the remedy to the severity of the problem and avoid taking disproportionate measures.

For example, given modest concerns about competition, a more appropriate measure would be to use an open process as suggested, allowing round by round price discovery but restricting transparency in the auction, so bidders cannot at any point during the auction see who has requested how many scheduling rights at given prices. This removes the scope for strategic bidding, e.g. for strong bidders to bid for certain slots only to keep entrants or particular competitors out.

Another alternative where there are slightly more pressing concerns is to use a hybridised process, when rounds of open bidding are followed by a sealed bid (a so-called Anglo-Dutch Hybrid). This can combine some of the efficiency advantages of open auctions with the competition enhancing benefits of a sealed bid. All of these approaches are potentially applicable to the simultaneous auctioning of many airport slots provided that combinatorial sealed bids are used.

8.4 Responsibility for intervention

Who would be responsible for assessing whether intervention is required and, if so, for designing appropriate safeguards? There are three principal options:

- the airport operator;
- the coordinator; or

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• the national competition authority (NCA) or other relevant regulatory body.

It is not the case that these various bodies would all have similar objectives in terms of designing an auction process to protect and promote competition in downstream air transport service markets.

281. The airport operator may be a natural candidate to be responsible for designing and implementing an auction, particularly if the airport operator is considered to own the slots to be allocated. There are various possible incentives that the airport operator might have in this process:

• The airport operator may have an incentive to maximise the revenue generated by the auction which, if there are competition concerns, it would do by not trying to promote competition amongst airlines. Rather, the airport operator would be content with ineffective competition in downstream markets for air transport services provided that it could capture some of the rents through competition amongst airlines for slots. This would not be relevant if either the airport were well-regulated or if there were competition amongst airports. Although major UK airports are subject to economic regulation, this is not necessarily true of other EU airports with strong positions.

• Even if an airport is well-regulated and would not have an incentive to earn revenues from an auction, it might still be neutral about competition that would benefit consumers. With economic regulation in place, auction revenues would count towards the returns it earns on its assets, so other charges the airport sets would need to be reduced to avoid excess returns. This leaves the airport broadly agnostic about auction revenues. Given this, it might want to simplify an auction to minimise implementation costs or demands on its management time.

282. Therefore, regardless of whether the airport operator has an incentive to maximise revenues or not, it does not have a clear incentive to ensure competition in downstream markets. Therefore, it is doubtful that an airport operator would incur the costs associated with a competition assessment and design of appropriate measures to increase the competitiveness of auction outcomes if this task was delegated to it.

283. Another option is that the coordinator takes responsibility for designing and implementing the auction. The revenue from an auction would not fall to the coordinator so, unlike the airport operator, the coordinator does not have a potential incentive to maximise revenues. The coordinator may be well placed to design an auction format that promotes equal access to slots for all airlines, as it currently administers the slot allocation in a non-discriminatory manner and this has long been part of its function. However, the coordinator (in the UK) is ultimately owned by a number of airlines who operate from congested airports so the coordinator may not have an incentive to design a mechanism which maximised downstream competition.
284. This leaves an obvious role for NCAs to oversee the process in some manner. NCAs already have some powers to do this. In the UK, the OFT can conduct a market study and make market investigation references to the Competition Commission under existing competition laws where existing features of the market appear to be preventing, restricting or distorting competition. However, market studies or investigations are time consuming and the process would have to be timed such that the findings were available to feed into the auction design. A similar proactive market study is not possible in all European jurisdictions.

285. A legal basis for assessment and intervention on competition grounds could be introduced in a revised set of Slot Regulations. This does not need to be onerous on the coordinator, airports or NCAs. For example, new Slot Regulations could require proposals for slot auctions to be notified to NCAs a certain time in advance of implementation. NCAs would then have the power to request changes to the rules on competition grounds. There could be a presumption of permission, so that if the NCA had not raised objections within some time limit, the auction could go ahead. The details of how such an approach might apply would need to be explored further ahead of any revisions to the Slot Regulations.

286. Such an approach would mesh well with taking a broader approach to defining the objectives for slot allocation. At present, the Slot Regulations are very detailed about the mechanics of slot allocation and yet do not clearly establish a set of public policy objectives for slot allocation. Drawing on parallels with other sectors where scarce rights are allocated, three broad objectives are important:

- promotion of economically efficient usage;
- protection and promotion of competition in services derived from slots; and
- non-discriminatory treatment of airlines.

Whether or not these principles had been applied would be the relevant question for NCAs. Establishing such principles would also provide a much clearer basis for private parties to complain about slot allocation procedures.

287. In the event that a Government body was directly responsible for the design of the process for allocating new capacity, many of the concerns expressed above would drop away, as the choice of award process would presumably be driven by public interest criteria. However, it would be important to establish what the relevant objectives were and to provide some safeguard in case a Member State did not pursue appropriate objectives (for example

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45 See, for example, the Authorisation Directive for radio spectrum licensing and the Licensing Directive that preceded it.
to favour a flag carrier). By enshrining these objectives in revised Slot Regulations, there would be the potential for complaint to the European Commission if a Member State took an approach contradictory to these objectives.
9 Nature of usage rights

Summary

- Indefinite duration usage rights are more likely to stimulate secondary trading and provide a stable investment environment for airlines.
- Only serious competition failures in downstream markets may warrant time limited slots.
- Whether restrictions on use of slots such as “use-it-or-lose-it” should apply is a carefully balanced argument and depends on the extent of secondary market frictions.
- There is no case for restricting who can bid for slots, as this prevents slots from being used as collateral to against loans and discourages entry.

288. In this section we consider the definition of usage rights that might be appropriate for allocating new capacity and touch briefly on who can bid for such usage rights in an auction. We are concerned here with the slot usage right ultimately granted to airlines, as opposed to any ‘scheduling right’ allocated as an intermediate step in the overall allocation process for slots. We have assumed that usage rights to new capacity, once awarded in an auction, will operate in the same manner as the effectively indefinite usage rights tied to existing capacity. However many of the arguments presented would apply equally in the case of reform of the current system.

289. The main issues we need to consider are:

- the duration of usage rights, in particular whether they should be finite or indefinite;
- whether there should be any restrictions on transfer of the usage rights in the secondary market; and
- whether there should be ‘use it or lose it’ restrictions on usage of the rights.

We consider these in turn in the following sections.

290. Our main concerns arise because the definition of usage rights may affect the efficiency of secondary markets. Conversely, there may also be some frictions in the secondary market that justify certain restrictions on usage rights. In addition, certain restrictions on trade or use may be necessary if there are significant concerns about competition.
9.1 Duration of usage rights

291. We argue that usage rights to new capacity should have indefinite duration and there are five main issues that we have considered in determining the appropriate duration of usage rights:

- the impact of limited duration usage rights on investment incentives and forward planning by airlines;
- the impact of limited duration usage rights on the liquidity of the secondary market;
- whether secondary market imperfections suggest that slots should come back for primary re-allocation from time to time;
- whether it is necessary to foster competition and ensure that strong incumbents are challenged to win back slots on a regular basis; and
- whether airports might need to recover usage rights to allow for reconfiguration of the capacity they offer.

9.1.1 Incentives for sunk investment

292. Airlines undertake a number of investments: most obviously, aircraft need to be purchased or leased. An aircraft can be deployed on a different route, sold or leased and hence the investment would not be tied to a particular slot or the duration of usage rights. Investment in fungible assets is little affected by slots having limited durations.

293. However, airlines need to undertake complementary investments in order to offer services using airport slots. For example, routes and networks of routes need to be developed and marketed to customers. These expenditures are effectively investments that need to be recouped over time. Some of these investments may be sunk, in the sense that they are linked to a particular use of a slot and cannot be recovered by selling the assets involved or putting them to alternative uses.

294. It is these sunk investments that are potentially discouraged if the duration of a usage right is too short. At first sight, this suggests that usage rights need to be sufficiently long though not necessarily indefinite.

9.1.2 Secondary trading of usage rights with limited duration

295. Secondary markets in slots should be encouraged to maximise the efficiency with which slots are used and promote competition in air traffic services. If new capacity was awarded with finite duration, a usage right loses value as its remaining duration decreases and it becomes unsellable in the secondary market.
Therefore, finite duration usage rights will necessarily restrict the efficiency of the secondary market.\footnote{This has been observed for time limited radio spectrum licences in New Zealand which pioneered the introduction of secondary trading in spectrum usage rights. Initially, 20 year licences were awarded with an option for renewal subject to a five year notice of the terms and conditions for renewal. As these licences have come towards the deadline for announcement of the terms and conditions for renewal, the uncertainty has inhibited secondary trading.}

Moreover, if finite duration rights expire at different times (as might be the case if new capacity is phased in), different classes of usage rights are effectively created within secondary markets. Potentially, as new capacity was issued at various times, a large number of classes of usage right could be created with different times to run. From a practical perspective, it could also be difficult and complex to track usage rights with different expiry dates.

In the secondary market, usage rights resulting from the allocation of new capacity would be traded alongside existing grandfather rights. These grandfather rights effectively have indefinite duration under current arrangements representing yet another, and predominant, class of usage rights.

This creates a strong reason for using indefinite length usage rights where possible, as there is a single class of usage right subject to secondary trade. This would increase the thickness of secondary markets, decrease search and matching problems and reduce price volatility. Indefinite usage rights do not prevent airlines from trading usage rights for a time limited period in the secondary market, for example through leasing arrangements.

9.1.3 Secondary market failures and finite duration usage rights

So far, we have seen that there is quite a strong case for using indefinite duration usage rights where possible. However, where we can anticipate significant secondary market frictions, there may be a case for using finite-length rights and regularly re-auctioning them.

These secondary market frictions may arise from bargaining inefficiencies, transactions costs or search costs as discussed in Section 3.3. Clearly many changes in current and potential users’ circumstances will result in secondary trading that maintains the efficiency of the slot allocation even when there are imperfections in the secondary market. However, where there are frictions in the secondary market, some changes in current and potential users’ circumstances will not result in changes to the slot allocation, even though the current allocation is no longer efficient. In effect, the efficiency of the slot allocation degrades over time. This...
degradation can be ‘reset’ by rerunning an efficient primary allocation mechanism from time to time.

301. The difficulty with this approach is that moving to finite-duration slots to allow this regular resetting may in fact create the problem it is trying to solve. As discussed above, short duration usage rights may themselves lead to frictions in the secondary market due to slots being untradable where their remaining lives are short.

302. As a result, using finite duration rights is only appropriate where we can anticipate sufficiently large frictions in the secondary market regardless of the effects of time limited rights themselves. Given the potential adverse effects of finite lifetimes on investment incentives and the sterilisation of slots with a short remaining duration, anticipated secondary market frictions need to be substantial and incapable of being addressed by appropriate rules concerning the organisation of the secondary market.

9.1.4 Competition enhancement

303. A somewhat related argument for finite duration usage rights is that incumbent airlines may enjoy some market power and may retain slots even when it is efficient for an alternative airline to acquire them. In effect, the entrant will not be able to pay sufficient to compensate the incumbent for loss of market power.

304. For this argument to have any merit, it is necessary that expiring slots are reallocated using a primary mechanism that is more favourable to producing competitive outcomes than the secondary market would be. For example, sealed bids or open auctions with limited transparency are typically thought to tip the playing field somewhat in favour of smaller bidders. In this case, regular expiry and reclaim of slots could be used as a policy tool to promote more competitive outcomes. Note that this would probably require rather short durations for usage rights (maybe five years or less) to have any significant effect if used on a rolling basis.

305. Whether this is a relevant consideration is clearly highly dependent on whether competition in downstream markets is effective. Only where there are significant failures in competition would it seem justifiable to move to short durations for usage of slots, as the adverse effects on investment incentives and secondary market efficiency need to be balanced against any improvement in the effectiveness of competition.

9.1.5 Curtailment of usage rights for operational reasons

306. In the case of infinite or long duration usage rights, the airport operator may need to end usage rights for operational reasons in exceptional circumstances. For example, capacity might be reconfigured or environmental constraints might require some future modification of usage rights. By itself, the need for possible future reclaim of usage rights is not a sufficient reason for needing finite length usage rights.
307. In the first instance, it might be possible for airports to buy back slots to permit reconfiguration of capacity. For example, it would even be possible to do this using an auction, where the airport invites airlines to sell back slots at a certain price.

308. Mechanisms for slot buy-back could be integrated with the sale of new capacity. For instance, such a mechanism could be used to allocate capacity on a third runway at Heathrow that would only be suitable for short-haul use as discussed in Section 7.2.1. Short-haul carriers with existing usage rights on existing runways might sell these back to permit those slots to be used for long-haul use, at the same time bidding for new capacity. Sales of existing slots, bids for use of those slots and sale of new capacity can be integrated into a single unitary auction.

309. In rare and exceptional circumstances, it might still be necessary for an airport to reclaim usage rights. Provided that these contingencies can be contractually defined, they can act as an encumbrance on a usage right. There is no necessity to use finite duration usage rights to deal with such eventualities. Clearly such encumbrances on usage rights should be kept to a minimum, as market mechanisms (both primary and secondary) work best when the assets being traded are clearly defined.

310. This approach has been recently adopted for radio spectrum management in the UK. Ofcom is currently issuing spectrum usage rights that are indefinite, but where a long notice period can be given to the user to vacate the spectrum for certain defined reasons relating to efficient spectrum management.

9.2 Restrictions on use and tradability

9.2.1 Restricting secondary trade

311. At present, the only significant practical restriction on the transfer of slots arises from the need to restrict resale of slots gained under the new entrant rule for a period of time. This provision in the Slot Regulations is necessary to avoid the new entrant rule being used as a means for other carriers who are not new entrants to gain slots. As argued in Section 4.3, we consider that there are strong arguments for discarding the new entrant rule for the allocation of a significant amount of new capacity. This would remove the need for any restrictions on secondary trading of slots.

47 In fact, many assets where the owner would appear to have broad rights to use and trade the asset are in fact encumbered in this way. For example, houses and land can be compulsorily purchased under certain defined circumstances. Shares in listed companies can be compulsorily purchased from their owners in certain circumstances in takeovers.
312. Furthermore, such restrictions may be difficult to enforce if slot users structure their businesses such that slots were held in holding companies whose only purchase was to hold slots (so-called special purpose vehicles). Rather than transferring a slot, the holding company could be transferred. Such arrangements are commonly used for buying radio spectrum licences and other key business assets and demonstrate the difficulties than can arise in practice when trying to restrict secondary trading.

9.2.2 ‘Use it or lose it’

313. At present, slot users are subject to a ‘use it or lose it’ obligation. The arguments for whether such an obligation is necessary depend on balancing two main considerations.

314. ‘Use it or lose it’ clearly restricts the ability of airlines to hold slots in order to give them an option to expand or reconfigure their services. In the current environment, such an option is valuable due to the difficulties of obtaining slots on the secondary market. This is one of reasons that we see ‘baby-sitting’ of slots. Giving airlines more flexibility to hold slots in reserve might encourage competition, as successive routes can be rapidly expanded and so a barrier to expansion is reduced.

315. On the other hand, if there are frictions in secondary markets, current holders of slots may not be fully exposed to the opportunity cost of holding slots. The opportunity cost is the highest willingness to pay of potential users. Where there are secondary market frictions, it is possible that the opportunity cost might exceed the value that the current holder of a slot places on it. However, despite another potential user being prepared to pay more than the current user, trade does not occur. Clearly there is a limit to the extent to which opportunity costs can exceed the value to the current user, as if this difference becomes too large any secondary market frictions will be overcome and trade will occur.

316. If current users are somewhat insulated from opportunity cost by secondary market frictions, a ‘use it or lose it’ rule can mitigate hoarding.

9.3 Who can bid?

317. There is no compelling argument for restricting who can bid for slots. There may be benefits from bodies other than airlines holding slots. For example, there could be some benefit to a body holding a modest portfolio of slots that it could then lease out to smaller airlines, effectively acting as a slot manager for a group of airlines. For small point-to-point operators, this might provide some of the flexibility of being able to access a portfolio of slots that is currently enjoyed by larger airlines. This is somewhat analogous to current arrangements for aircraft leasing and to how slots have been shared by airlines within the same alliances.
318. A further important consideration is that airlines (particularly entrants) might wish to use slots as collateral for raising finance. For example, a loan contract might provide for slots to be transferred to the financial institution making a loan under certain defined default conditions. Restricting ownership of slots to just airlines would frustrate such possibilities. This would disproportionately impact on smaller airlines and entrants, and might reduce the effectiveness of competition.
10 Costs and benefits

Summary

- Conservative estimates of the benefit of auctions for allocating a significant amount of new capacity show that the benefits far outweigh implementation costs.

- Although there are potential costs from adverse effects on competition and increased negative externalities, these only arise if appropriate mitigating action is not taken.

319. In this section, we investigate the potential magnitude of gains in economic welfare resulting from using an auction to allocate new capacity at a congested airport. We concentrate on the potential impact of improvements in the efficiency of slot allocation. The aviation sector is a significant source of value-added in its own right; furthermore, purchasers of its services enjoy substantial benefit in terms of consumer surplus, either as end-customers (e.g. leisure travels) or as an input into other sectors of the economy (e.g. business travels and air freight). Therefore, even small increases in the efficiency with which a modest increment in capacity is allocated can lead to significant gains across the economy at large.

320. Given that obtaining a reasonable central estimate of these benefits is fraught with uncertainty, the approach we take is to use various stylised models to estimate a plausible lower bound on the potential benefits of using an auction at a congested airport. Many of the assumptions we need to make along the way could be specified differently and yield significantly different answers. However, by taking conservative assumptions throughout, we can be reasonably sure that our results constitute a lower bound on benefits. Even so, it is best to consider this as an exercise in identifying the likely order of magnitude of economic benefits related to efficiency gains in primary allocation of slots.

321. Clearly the magnitude of potential benefits from the use of auctions for primary allocation depends on there being excess demand for slots. We consider the scenario of a 10% increase in capacity at Heathrow. We necessarily have to choose a specific example in order to estimate a value for benefits. Because Heathrow is congested throughout the day, this provides the clearest example.

322. Overall, we find that even a lower bound is substantial, plausibly in the order of billions of pounds (in net present value). This benefit is two orders of magnitude larger than any plausible implementation costs.
10.1 Overall approach

323. Our approach consists of the following steps:

- We take estimates of the economic value of UK air services from an existing study\(^{48}\) on the contribution of aviation to the UK economy;
- We identify the part of overall benefits of UK aviation likely to be related to the allocation of new capacity at Heathrow, based on a plausible new capacity scenario;
- We suppose that the benefits associated with new capacity are affected by the efficiency with which new capacity is allocated, and use our results on the potential efficiency gains from using an auction in order to estimate the benefits of using an auction to allocate new capacity at Heathrow;
- We estimate the potential efficiency loss from using an administrative allocation instead of an auction. We use theoretical results to estimate the potential efficiency of secondary trading;
- We consider the likely rate at which slots might be traded due to changing circumstances amongst airlines, as this leads to decay over time of any efficiency benefits of primary allocation over and above that achievable from the secondary market.

324. The individual steps of the calculation are developed in Annex 5. The calculations develop estimates of the likely magnitude of bargaining inefficiencies in secondary markets using a stylised example from Annex 4.

10.2 Results

325. Given the various assumptions as explained in Annex 5, we can estimate the potential benefits of using an auction for initial allocation of a 10% increase in capacity at an airport which is congested throughout the day. The base case for comparison is the use of an administrative allocation method with well-functioning secondary trading. The results are presented in Table 7 below.

326. The cases we consider are based around potential efficiency gains of auctions relative to administrative allocation of 7% and 16%, corresponding respectively to secondary market imperfections purely due to bargaining inefficiencies and due to both bargaining inefficiencies and matching problems between buyers and sellers (second column in the table below). We also test the impact of assumptions about how fast airline valuations of

\(^{48}\) The contribution of the aviation industry to the UK economy, Oxford Economic Forecasting, November 1999
slots change over time to erode the initial benefits of an efficient allocation (column three), the timing of new capacity (2006 and 2010 respectively, as in column one) and the share of total UK aviation that Heathrow represents (column four).

**Table 7: Estimated benefits of using auctions for primary allocation of a 10% capacity increment**

<table>
<thead>
<tr>
<th>Year of capacity increase</th>
<th>Efficiency gain of auction against administrative allocation (%)</th>
<th>Rate of secondary trading (% per annum)</th>
<th>Share of UK aviation benefits at affected airport (%)</th>
<th>Value added (2006 GBP billion net present value)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2006</td>
<td>7%</td>
<td>5%</td>
<td>30%</td>
<td>0.2</td>
</tr>
<tr>
<td></td>
<td>7%</td>
<td>1.5%</td>
<td>30%</td>
<td>0.3</td>
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<tr>
<td></td>
<td>16%</td>
<td>1.5%</td>
<td>30%</td>
<td>0.6</td>
</tr>
<tr>
<td></td>
<td>16%</td>
<td>1.5%</td>
<td>40%</td>
<td>0.8</td>
</tr>
<tr>
<td>2010</td>
<td>7%</td>
<td>5%</td>
<td>30%</td>
<td>0.3</td>
</tr>
<tr>
<td></td>
<td>7%</td>
<td>1.5%</td>
<td>30%</td>
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<td></td>
<td>16%</td>
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<td>30%</td>
<td>0.4</td>
</tr>
<tr>
<td></td>
<td>16%</td>
<td>1.5%</td>
<td>40%</td>
<td>1.0</td>
</tr>
</tbody>
</table>

327. Looking at the results in the final column, it can be seen that the most important factor affecting the results is the inefficiency of secondary trading, which we have derived from theoretical results. We find that with a 7% inefficiency in secondary trading, the benefit of using auctions would be at least £0.8bn (in net present value), whereas alternative assumptions of a 16% inefficiency substantially increase our estimates of the benefit up to around £3bn.

328. Assumptions about the extent of secondary trading in response to changing circumstances and the date at which the capacity increase applies are much less important.

10.2.1 Other benefits

329. In addition to the benefits included in our estimates, there may be a number of indirect benefits from increased efficiency in the use of scarce airport capacity. For example, the efficient allocation of airport slots should
Costs and benefits

enhance competition in downstream air traffic services to the benefit of consumers and businesses for whom air traffic services is an input to production. Increased competition in air traffic services would lead to better choice and quality as well as lower airfares. In turn, this may improve the competitiveness of UK businesses.

330. Secondary trading and especially auction processes can reveal information about the value of slots to airlines. This has the potential to assist in identifying when it is desirable to build more capacity. Where the price of slots exceeds the cost of additional capacity, including environmental costs, it is desirable to build more capacity. Furthermore, by encouraging airlines to migrate from peak to off-peak slots where possible, auctioning may improve capacity utilisation and avoid unnecessary capacity building. Therefore, auctions (and to some extent secondary trading even if auctions are not used) bring benefits in terms of planning and managing airport capacity.

10.3 Likely implementation costs

331. The one-off costs of implementing an auction include the costs of designing and implementing the auction incurred by the auctioneer, the cost of carrying out regulatory oversight incurred by the NCA or other government agency and the costs for bidders in preparing for the auction. Assuming there are 50 bidders wanting to participate in the auction and that they would each need two senior managers spending a year preparing valuations and bid strategy, the total costs may add up to £10-15 million as follows:

- 100 senior managers for a year at £80,000 p.a., total of £8mn; and
- design and implementation cost for auctioneer and Government of £5mn.49

332. Whilst the costs of implementing an auction are substantial, they are insignificant compared to the benefits.

10.3.1 Other costs

333. There are a variety of problems that could be introduced or exacerbated by the use of auctions. However, in each case there are mitigating actions that can largely eliminate the problem, so these do not give rise to material costs. In particular:

49 For example, it cost the Danish telecoms regulatory authority app. £2mn to design and implement an auction of a 3G spectrum licence in 2005. This included legal costs, consultants and government cost. Source: “Auction of Third-Generation (3G) Licence for Mobile Telephone Network, Information Memorandum, 18 November 2005”, issued by The National IT and Telecom Agency, Denmark.
Costs and benefits

• Whilst the potential for airlines to gain market power from cornering the market for slots exists, there are a variety of mitigating measures available if competition law is insufficient. These include appropriate auction design and, in the extreme, quantitative limits on slot holdings;

• State-aided airlines from outside the EU may be more able to acquire slots, in which case discriminatory measures might be required. However, similar issues might arise regardless of the mechanism used for slot allocation;

• Without appropriate measures to discourage noise and emissions (for example through higher charges for noisier aircraft or tradable noise or emissions quotas) charging for slots might encourage airlines to use larger aircraft which might be noisier or more polluting. However, providing that a system to encourage noise and emissions abatement is in place that provides appropriate incentives, using market mechanisms for allocation of slots should assist, rather than hinder, efficient abatement.

10.4 Distribution of benefits and costs

334. The estimation of benefits and costs above compares the total costs and benefits of auctions compared to an administrative allocation. It is agnostic about the distribution of such benefits and costs.

335. The costs of implementing the auction would fall to bidders (i.e. predominantly airlines) and the auctioneer (which may be the Government, the airport operator or the coordinator). The Government might also incur some regulatory costs in the assessment of auction rules against competition objectives as discussed in Section 8.

336. Although the auction revenue would represent an immediate monetary cost to the airlines who won slots in an auction, the revenue is a benefit to the recipient, be this the airport operator or the Government. If the airport operator received the auction revenue, economic regulation may require such revenue to be recycled back to industry through reductions in airport charges across the board, creating a broadly revenue-neutral situation for airlines as a whole. To the extent that auction revenues could be used to incentivise the airport operator to provide capacity and funding investment, there would be benefits for airlines that we have not considered.

337. Providing competition is effective, the benefits of a more efficient slot allocation, predominantly derived from increased consumer surplus, would primarily flow to UK consumers and businesses that use air traffic services as an input to production. The most cost effective airlines would benefit from opportunities to expand business, while airlines who may have received slots under an administrative system but do not have the highest willingness to pay will miss out.
11 Conclusions

338. This study has developed a practical allocation format for awarding a significant amount of new capacity at a congested airport, which combines:

- a relatively simple auction (first stage) that allocates scheduling rights; and
- detailed coordination carried out by the coordinator (second stage) given the specific requests for timed slots from scheduling rights holders.

We have called this a “two-stage hybrid allocation process”.

339. The auction of scheduling rights could be rolled out as an overlay to the current administrative system in the case of significant amounts of new capacity whilst continuing to allocate existing capacity in the current way. Therefore, this proposal would integrate well with existing approaches without requiring radical upheaval of the current allocation system. The two-stage, hybrid approach is relevant for airports where there is excess demand at peak hours only or throughout the day.

340. We have also considered reform of the administrative allocation system and, in particular, removing the new entrant rule for the allocation of a significant amount of new capacity. This would benefit consumers by removing barriers to airline expansion that currently limit the competition faced by larger airlines.

341. We are concerned that an administrative mechanism based on a set of predetermined criteria would fail to deliver much efficiency improvement whether or not the new entrant rule is removed. There is a fundamental problem of asymmetry of information between the coordinator and users of slots; therefore it is impossible for the coordinator to second-guess who could make best use of the slots. In some respects, we believe reform of the administrative system could be more difficult to implement than a two-stage hybrid approach because it would prove quite a challenge to agree a set of workable criteria for allocation.

342. Although industry stakeholders do not generally support the use of market based mechanisms for the allocation of airport slots, they have commented constructively on the feasibility of a two-stage hybrid approach and we have not identified any insurmountable problems to implementing this type of auction in any plausible scenarios for new capacity.

343. The full details of the auction format can only be finalised under the given circumstances of capacity to be released at a specific airport. We would therefore recommend experimental testing of the two-stage hybrid allocation under a given hypothetical (though realistic) scenario for release of new capacity. This could involve industry participants who would bid in a mock auction given fictional strategies and budgets. Participation could take
Conclusions

place over the internet using web-based software, as is commonly used for spectrum auctions. Such experimental testing would enable refinement of auction rules. It would allow the industry to understand more about auctions. It would also permit a more refined evaluation of the potential efficiency benefits of auctions. We are aware that a simulation exercise has been carried out in the US in relation to a potential auction of capacity at LaGuardia airport in New York. Unfortunately, we have thus far not been able to obtain access to any results of this exercise.

344. We have estimated the potential economic benefits from improving the efficiency of the allocation of slots at congested airports by introducing a market based approach to primary allocation. Although there are considerable uncertainties around any such calculations, there could plausibly be substantial economic benefits, even given modest increases in capacity.

345. In the example of a 10% increase in capacity at London Heathrow, these benefits range from a net present value of £0.8 to £3.6bn. In contrast, we estimate that there would be a one off cost of implementing an auction of £10-15mn. Based on the potential economic benefits derived from an efficient allocation of scarce airport capacity, there is a strong case for allocating a significant amount of new capacity by auctions.

346. The benefits of auctions are contingent on capacity being scarce. If there is no scarcity, primary allocation is irrelevant as all potential users can get slots at or close to their preferred time without hindrance. In the absence of scarcity, the current administrative system would do as well as any other approach.

347. Absence of scarcity is not the same as there being excess supply of slots across the whole day or week. If there is excess demand for peak slots, there is scarcity. The 2004 NERA study counted seven airports in the EU that experience excess demand throughout the day and another 14 airports where there is excess demand at peak times of the day. Therefore, according to the correct definition of scarcity, there is scarcity at a small but significant number of EU airports. Whilst we believe that auctions could be of benefit for allocating new capacity not just at Heathrow, clearly this model is not necessary at the majority of EU airports.

348. At all airports with scarcity, there could be a benefit to using a market based allocation mechanism to allocate new capacity. Besides the implementation costs, there is little downside to using auctions; if there is little scarcity, prices paid by bidders in the auction will be low.

349. This study strongly suggests that the most efficient use of slots would be gained from revising the Slot Regulations to allow auctions for primary allocation under a permissive approach. This would allow flexibility for individual Member States to design auctions based on the demand and supply structure at a given airport. It should not be prescriptive about the
format to be used. Experience shows that a successful auction requires careful consideration of specific local conditions.  

350. A permissive approach would allow the UK to promote the efficient allocation of scarce airport capacity in the UK. This could bring significant benefits to users of UK airports. Although primary efficiency gains might appear modest, the large contribution of the aviation sector to the UK economy means that benefits are significant and far outstrip any implementation costs.

351. In the broadest terms, there is a noticeable difference to the approach taken in the current Slot Regulations to specifying how slots should be allocated and the approach that the EU has adopted to allocation of scarce assets in other sectors. The current Slot Regulations are detailed and prescriptive in how slots should be allocated rather than setting broad principles and clear policy goals. An analogy to allocation of airport slot is the allocation of radio frequencies, which are also a scarce resource in some instances. In the case of radio spectrum, European policy is much more concerned with broad principles, such as efficient use, non-discriminatory access and ensuring that Member States cannot unreasonably withhold supply. Establishing similar broad objectives for slot allocation would seem desirable, with Member States then able to follow approaches appropriate to their circumstances.

352. UK airlines use other congested European airports and would benefit from being able to gain access where they have a strong business case against competing users. Hence there may be a case for considering whether a revised European Regulation should include an obligation on Member States to ensure that airport capacity is not unreasonably withheld and new capacity is allocated efficiently and in a non-discriminatory manner. Such an obligation would not require the use of auctions or any other particular process of primary allocation by Member States. Nevertheless, this would create the opportunity for airlines in one Member State to seek redress if slot allocation in another Member State limited access without due cause.

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50 Auctions of radio spectrum have been conducted across the EU using a wide range of formats such as sealed bids or open, multi round auctions.

51 Article 5(2) of the Authorisation Directive (Directive 2002/20/EC of the European Parliament and of the Council of 7 March 2002 on the authorisation of electronic communications networks and services), specifies that Member States shall grant rights of use for radio frequencies upon requests subject to ensuring the efficient use of radio frequencies.
Annex 1: Discussion with industry stakeholders

The Department for Transport has set up an Industry Forum consisting of UK airlines, airport operators and the coordinator with whom the DfT wishes to discuss issues relating to airport slots. The Industry Forum met in February 2006 at the outset of this study to discuss the scope of and process for the study.

DotEcon and AviaSolutions then held a series of bilateral discussions with UK and non-UK industry stakeholders led by AviaSolutions to discuss the feasibility of a range of alternative allocation mechanisms. The various organisations that we spoke to were (in alphabetical order):

- ACI Europe
- Airport Coordination Limited
- Aviation Environment Federation
- BAA
- BAR UK
- BATA
- BMI
- British Airways
- Continental Airlines
- easyjet
- IATA
- Manchester Airports Group
- Thomsonfly
- Virgin Atlantic
- United Airways

Prior to the meetings, DotEcon and AviaSolutions circulated a note to stakeholders detailing five different alternative mechanisms for discussion with stakeholders.

The Industry Forum met to discuss an interim report preceding this report in April after which a small number of stakeholders provided us with detailed written comments. The Industry Forum is due to meet in July to discuss the conclusions and recommendations arising from this report.
Annex 2: Alternative mechanisms discussed with stakeholders

This annex contains the initial descriptions of the five alternative mechanisms which formed the basis of the one-to-one discussions with industry stakeholders. The two-stage hybrid process described in Section 7 is a further development of the mechanism described in Section A2.4 of this Annex.

A 2.1 Mechanism I: Administrative process without new entrant rule

We first consider how the current administrative allocation mechanism for allocating pool slots may be amended to allocate a significant amount of new capacity.

Under Regulation 95/93, the current administrative allocation mechanism gives priority to entrants for up to 50% of pool slots. Although this rule may benefit competition on some routes, it is often considered that, if followed to the letter, the entrant rule is likely to give rise to an inefficient allocation of slots by spreading the available slots “too thinly”. In particular, this rule only assists airlines with very small slot holdings and arguably does little to assist expansion by existing medium-sized airlines or larger scale entry.

Removing the new entrant rule would mean that the secondary allocation criteria used by the coordinator would effectively become primary criteria and take a much greater role in determining outcomes. The burden on the coordinator would be considerably greater than at present.

Although this mechanism is derived from the current administrative system, we should stress that this section describes a hypothetical situation where a revised system would allocate a significant amount of new capacity, it is not a description of how the coordinator currently allocates pool slots.

A 2.1.1 Design of lots

The lots\textsuperscript{52} would be identical to the current system, i.e. a specified time (to the nearest five minutes) and day of the week for a particular type and size of aircraft to arrive at or depart from the stand, coupled with the adequate stand and terminal facilities. Therefore, a lot is a bundle of usage rights. The airport operator, taking advice from air traffic control would make an estimate of the number of slots available within each hour, the scheduling limits, with additional sub-constraints for 10 or 15 minute periods to smooth demand within the hour based on the assumed traffic mix.

\textsuperscript{52} We use the term “lot” throughout to refer to the unit being allocated. This may correspond exactly to a slot, but in some mechanisms will not.
Although slots are not specifically coupled, the coordinator would allocate time windows in pairs (one for landing and one for take-off). However, an airline could apply for a single slot if for example they wished to couple it with an existing slot to improve the timings of an existing pair.

A 2.1.2 Step-by-step process

The coordinator would invite airlines to submit applications for slots. As under the current process, airlines would apply for slots for a particular time and day(s) of the week specifying the flight number, aircraft type and number of seats. For each slot that is available, the administrator considers the matching applications. Slots can be allocated both on a daily basis (e.g. 08.00 every day of the week), on a weekly basis (e.g. 21.30 every Tuesday, Thursday and Saturday) or for part of the season only (e.g. 09.00 every Saturday in November, December, January and February).

A 2.1.3 Selection criteria

Without the new entrant rule, the only primary criteria for the coordinator to consider would be to prioritise year round services over part season requests. In addition to this, licensing and bilateral agreements may restrict some airlines applying for slots for particular routes at all.

The administrator would need to rely strongly on the secondary criteria for determining the allocation. There are seven secondary criteria used in the current system, falling into two types. Firstly, there are four criteria of a practical, operational nature, which the administrator can apply immediately to competing slot requests and which seem aimed at maximising usage of the available capacity:

- effective period of operation;
- frequency of operation;
- world-wide scheduling constraints e.g. curfews; and
- local guidelines.

Secondly, there are three criteria which seem aimed at encouraging the airport coordinator to consider broader issues such as competition and economic efficiency:

- size and type of market;
- competition; and
- requirements of the travelling public.

However, these broader considerations are not criteria that can be applied objectively. They would need to be substantially interpreted. It is unclear how the coordinator would trade them off.

For example, how would the coordinator allocate slots to improve competition without developing rules about what competition means. But such rules rely on notions that say three competitors is preferable to two on a given route. Such predetermined rules for how to measure competition
Annex 2

are however problematic, as on some routes, competition may be strengthened by adding more frequencies for a second airline, yet on other routes introduction of a third or fourth airline may be required to promote competition. If on the other hand, the criteria are left open for the coordinator to consider competition in a more flexible way, this may produce considerable uncertainty about outcomes and leave the resulting outcome open to legal challenge as outcomes are more arguable.

To avoid claims of discrimination, the airport coordinator may have to issue high-level guidelines setting out how it intends to apply the secondary criteria ahead of the start of allocation of new capacity, as these would have a critical role in determining overall outcomes. Agreeing these guidelines would be likely to involve not just the airport operator and the Coordination Committee but also stakeholders, CAA, DfT and possibly OFT.

It would be possible to modify the existing secondary criteria or add additional criteria if this were deemed relevant. For example, to consider how long an applicant has already waited for a slot or whether to give airlines priority who have no record of slot abuse.

A 2.1.4 Selection process

Slots are considered by the coordinator on an hour-by-hour and day-by-day basis. For each hour that capacity is available, the airport coordinator aggregates demand and compares to the available slots by adding the details of the selected applicant to the coordinator’s computer database. The coordinator relies on a model of airport capacity and scheduling limits to ensure feasibility of each allocation. The criteria above would then be applied to choose amongst feasible applications. Considering demand hour by hour makes it difficult for the coordinator to consider the full range of trade-offs if there is a large amount of capacity to allocate.

If slot requests of airlines are naturally conditional in nature, e.g. a new entrant would only wish to start operations from the airport in question if it could achieve a certain minimum of slots, the initial allocation may need to be followed by activity in the secondary market. Although the coordinator can consider conditional requests, it is difficult when there is a large number of slots available.

There is likely to be a large degree of oversubscription, potentially stressing the allocation process. With a significant amount of new capacity available, this has the potential to become a real problem for the allocation system. Relaxation of the new entrant rule would only make the oversubscription problem worse. With the new entrant rule relaxed, incumbent airlines are likely to submit a large number of applications as there would be little to lose and much to gain. Further, at highly congested airports, such slots would also be valuable in the secondary market, so there may also be speculative applications seeking windfall gains.

A 2.1.5 Participant requirements

Airlines would submit applications for slots as they would currently apply to the pool on the basis of the announced slot availability. These applications would specify:
• day of the week, requested time and frequency;
• arrival or departure;
• effective dates of operation (i.e. full or partial season);
• aircraft type and number of seats;
• proposed terminal of operation; and
• destination.

Applications could specify a maximum number of slots that they wish to be awarded and applications for slots could be pairs (take-off and landing).

Given that winners of slots might not necessarily achieve either the number of slots or the configuration of timings that they would ideally want, there may need to be a further step of secondary trading.
A 2.2 Mechanism II: Administrative process with business cases

Mechanism I considers how the current administrative system may work if the new entrant priority rule was removed. There is a concern that when allocating a significant amount of new capacity (especially when there is strong excess demand), a process of allocating slots hour by hour would struggle to make use of all the possible trade-offs in meeting demand and so not produce efficient outcomes. In particular, it would be difficult to consider how the new capacity should be shared across applicants when the process only considers applications for slots on a one-by-one basis.

A possible modification to the current administrative system would be to take a step back and trade off competing requests at a higher level in a so-called comparative assessment exercise or “beauty contest” as a first stage before embarking on the detailed scheduling exercise. Therefore, this would be a two-stage process. The first stage for trading off competing demands would involve a broad assessment of who should get what share of the capacity. The second stage would allocate specific slot timings to successful application from the first stage. A third stage may be required to allocate incremental capacity which proves to be available when the exact traffic mix is known.

A comparative assessment exercise would be similar to the method by which Government concessions, particularly licences for the use of radio spectrum, have been allocated in the past and are still allocated in other jurisdictions where market methods have not been favoured or available. There is also precedent in aviation, namely the process for distributing traffic rights under the UK’s scarce bilateral capacity procedures as conducted by the CAA.

A 2.2.1 Design of lots

**Scheduling rights**

We propose that in the first stage applications are made for ‘scheduling rights’. A scheduling right will entitle the holder to operate either a weekly take-off or landing slot on one day of the week within a broad time window and it would include runway capacity as well as adequate stand and terminal capacity. In order to make an application for a specific timing in the second stage, an applicant would need to hold an appropriate scheduling right won in the first stage.

It would not be appropriate to have a single, undifferentiated scheduling right, as this would be unable to distinguish between applications for peak and much less valuable off-peak slots. Conversely, having very many categories of scheduling rights related to different times of day would risk closing off the possibility of retiming slot applications in the second stage and so not use capacity efficiently; effectively the first stage of the process would be determining detailed slot timings and so not have provided any useful additional function. Therefore, slots that are likely to be close substitutes should fall into the same category of scheduling right.

The initial proposal is therefore to group available slots into five broad groupings of scheduling rights throughout the day, any day of the week:
### Table 8: Proposed categories of scheduling rights

<table>
<thead>
<tr>
<th>Category</th>
<th>Time window</th>
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</thead>
<tbody>
<tr>
<td>A</td>
<td>06:00-09:00</td>
</tr>
<tr>
<td>B</td>
<td>09:00-12:00</td>
</tr>
<tr>
<td>C</td>
<td>12:00-16:00</td>
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<tr>
<td>D</td>
<td>16:00-20:00</td>
</tr>
<tr>
<td>E</td>
<td>20:00-23:00</td>
</tr>
</tbody>
</table>

As far as we understand, the demand (and hence slot prices) at highly congested airports such as Heathrow does not vary greatly by day of the week. But if demand was found to vary across the days of the week the categories could be further subdivided, for example into Monday-Friday and Saturday-Sunday. If required, the time windows could also overlap to some extent, as the exact scheduling to take place in the second stage would ensure a final allocation that is compatible within overall scheduling limits.

**Slots allocated in the second stage**

The allocation of exact timings would be determined by the coordinator in a second stage scheduling process. In order to schedule an air movement, a airline would have to have won the appropriate scheduling rights in the first stage process, or else bought such rights in the secondary market.

There are a number of options for how scheduling rights could operate over future years and seasons. In particular, scheduling rights could last for more than one season or year. In this case, each season a new scheduling process would be conducted, but scheduling rights would endure for more than a season. Between scheduling rounds, scheduling rights could be bought and sold in the secondary market. This approach could be advantageous if the broadly defined scheduling rights indeed form categories of homogenous goods that are more tradable than slots with a specific timing attached. Alternatively, the specific slot timings allocated in the second stage could be carried over and airlines be allowed to make requests for re-timings as in the current systems. The coordinator told us that it is difficult to define terminal and stand capacity except at the detailed level of specific timings. An airport operator explained that the adjustments it may have to make, for example to match the type of stands to the size of aircrafts operating in and out of that airport, are time consuming to implement. If such practical constraints bind, it may be necessary that specific timings are carried over.

**A 2.2.2 Step-by-step process**

The airport operator and air traffic control would decide how much capacity is to become available and how it is phased. The coordinator would then announce the available supply for allocation for each of the years to be allocated. Airlines would have to submit an initial, as well as possible
further requests for their desired number of scheduling rights in each category each year accompanied by a business plan.

The business plans would have to outline the proposed usage of the number of slots requested and the benefits derived there from, at the very least covering a list of predetermined criteria. However, airlines would be free to make any additional points that they believe would benefit their case.

The criteria should include broad considerations such as economic efficiency and benefits to competition and hence the assessment of business cases against such criteria would probably require a committee with wider representation than the current coordinator, for example by the CAA and/or the DfT. The list of criteria could be developed starting from the CAA’s guidance on the economic framework for considering cases relating to the allocation of scarce bilateral capacity as described in Annex 8 of Official Record Series 1:

“...the CAA expects each applicant to set out what the benefit to passengers of its proposals will be, with supporting evidence on how this benefit is distributed among the different traffic flows and the different passenger types, distinguishing between fare and non-fare benefits. […] [..]

This supporting evidence, quantified to the maximum extent possible, should indicate:

- the main traffic flows affected by an applicant’s proposals;
- the current size of those flows and their expected growth rate in the near future;
- the current passenger mix in these flows;
- the pricing and service proposals for each of the affected flows;
- the extent to which traffic from these existing flows will use the proposed services;
- the degree to which demand is stimulated;
- the price and other benefits that the applicant’s proposals will bring compared with the existing situation; and
- the way in which the benefits of these proposals split between UK and foreign residents.”

However, unlike the task of licensing airlines for a particular set of given, newly liberalised routes, the allocation of scheduling rights will also
encompass deciding the mix of short and long haul flights and the mix of
UK-based and foreign airlines.  

Having received all applications, the coordinator or the committee would
score all of these independently and rank them according to the score. The
number of requested scheduling rights would then be allocated to the
application with the highest score, then to the applicant with the second
highest score and so forth. At some point, the available capacity is
exhausted to a point whereby the next request in the rank cannot be met,
for example because there are 16 scheduling rights remaining to allocate but
the next application in the rank has applied for 20. In that case the
allocation process would jump to the next application until as much of the
capacity as possible was allocated. The requested number of slots in an
application would only be considered in its entirety.

This means that the more scheduling rights an airline is requesting, the
better its business case has to be. For any given score, a request is more
likely to be met, the fewer scheduling rights requested. Knowing this and
the total availability of scheduling rights in each category, airlines will have
to make a strategic decision as to how many scheduling rights to request in
its initial application and how many to request in further applications.

The second stage scheduling process would not be unlike the scheduling
process according to historic usage and changed historics that the
coordinator currently undertakes in the sense that there are as many
requests as there are slots.

A 2.2.3 Participant requirements

The main steps for participants are to:

• decide how many scheduling rights are required in each category;

• decide how many scheduling rights to request in one application and
  how many supplementary applications to consider (a strategic
decision); and

53 Some of the criteria will vary systematically between different types of routes, so
the scoring will have to be performed against a relative rather than an absolute scale
of say 1 to 10. For example, aircrafts will generally be larger on long haul than short
haul routes so a score of 8 out of 10 for a long haul flight may correspond to higher
volume traffic flows than a score of 8 out of 10 for a short haul flight. This example
clearly shows the tension in a system without prices to signal the willingness to pay
for slots of users. An absolute scoring would clearly favour long haul routes over
short haul routes on this type of criterion. Whilst on average, a long haul flight
carrying more passengers may be expected to deliver more net benefits than a flight
with fewer seats, there are some short haul flights which are clearly very valuable
because they feed long haul flights or carry particularly many business users whose
demand is less price sensitive. A relative scoring system on the other hand, leaves
the coordinator or the committee with the difficult task of determining the efficient
mix of long haul and short haul flights.
• prepare business cases for each application.

Given how many scheduling rights are won in the comparative assessment exercise, there would follow a decision about whether to buy or sell scheduling rights in a secondary market. On a similar timetable to that of the present system, detailed requests for specific slot timings would be made close to the start of each season.
A 2.3 Mechanism III: Administrative process with set prices

Another possible method of rationing demand to improve the efficiency of an administrative allocation is to set prices for slots. Set prices present a method of allocating new capacity whereby the current system of administrative allocation of airport slots would apply, but with the distinct variant that in applying for a new capacity slot, an airline would state its willingness to pay a flat fee for the rights to use that slot.

The concept of higher posted prices was put forward by NERA in a study for the European Commission, DG TREN\(^54\) in the context of encouraging airlines to return slots, which they hold under grandfather rights but use inefficiently, by making the opportunity cost of holding slots a real cost. Our intention is somewhat different – to use pricing as an initial screen for applications, even if administrative procedures would still be required to decide between competing requests.

A 2.3.1 Design of lots

The lots considered for this allocation mechanism would be identical to those allocated under the current administrative system (and under Mechanism 1) i.e. specified timings and day of the week combining runway, stand and terminal capacity. The usage rights could either be indefinite similar to the current grandfather rights, or for a time limited period although this must be clear ahead of the process as the duration of rights obviously has an impact on price setting.

A 2.3.2 Step-by-step process

Having been informed about the new capacity that would become available and when by the airport operator and air traffic control, the first step for the coordinator or administrator of the allocation process would be to set a price for the different slots. The setting of prices would involve forecasting of demand for new capacity slots under different pricing schedules and considering pricing options which would broadly equate the number of new slots with the number of requests.

As new capacity may become available throughout the day, part of the pricing decision would be whether prices would be set to incorporate a differential to control for varying demand across peak and off-peak hours i.e. whether there would be a higher price for peak slots. If there is higher demand for new capacity at peak times and prices are set as a means to increase the efficiency of allocating scarce capacity then the price set should be higher for peak slots. Peak and off-peak pricing also would also help to reduce the possibility that some new slots are highly over-subscribed while others are not sought by any airline. In order to produce as accurate

forecasts as possible, the coordinator or administrator of the process would probably need to develop complex demand forecasting models. The current prices as observed in the secondary market may form some guidance where a limited amount of additional capacity becomes available (e.g. 10-15%), but would certainly not be informative where the supply increases substantially (e.g. by 30-50%). In addition, any forecasting exercise could be undermined by significant demand shocks (e.g. 9/11 and bird flu) that could substantially affect the commercial value of slots.

Determining prices requires that a number of considerations be taken into account. If prices were set too low, demand would outstrip the supply of new capacity and so there would still be a significant role for administrative criteria in resolving competing demands. Alternatively, if prices are set too high, there may not be demand for all of the new slots, resulting in new capacity not being fully utilised. In practice, prices are more likely to be set too low rather than too high as they are only intended to form an initial filter to assist the administrative allocation system.

Once prices for new capacity have been set and announced, airlines that are willing to pay those prices apply for the desired slots. As each slot may still be oversubscribed if the prices are set too low, slots will be allocated through a process analogous to the process in place for allocating current pool slots subject to the criteria discussed in Mechanism 1 with the key difference being that those airlines that are allocated slots will have to pay the set price.

The pricing mechanism allows only limited flexibility for airlines to make their application for individual slots conditional on certain other slots. This means that airlines run the risk of ending up with an unsatisfactory portfolio of slots, which would have to be addressed by buying and selling slots in a secondary market immediately after the allocation.

A 2.3.3 Participant requirements

Airlines would have had to undertake detailed business planning to decide their willingness to pay for which and how many slots. Accepting the set prices for the different categories of slots, they would have to submit applications as they would currently apply to the pool, specifying:

- day of the week, time window and frequency;
- full season or partial season;
- aircraft type and number of seats; and
- destination.
A 2.4 Mechanism IV: Hybrid auction process

This mechanism would introduce a simple auction into the allocation process. It has elements of Mechanism II, in that the process would have two stages, the first in which airlines competed for scheduling rights, followed by a second stage in which specific slot timings were scheduled. It would use a price mechanism to select amongst potentially competing demands for scheduling rights, somewhat like Mechanism III. However, it would use an auction to determine the appropriate charge for a scheduling right, rather than simply setting prices with little knowledge about the market clearing level.

The award process would proceed in three stages:

- A ‘clock auction’ would assign scheduling rights for the large majority of available capacity. A scheduling right would guarantee a successful bidder the right to operate either a take-off or landing on a weekly basis within a broad time window on one day of the week;

- A further process to assign specific slots to successful bidders. This could be either an auction or an administrative process. We focus on using an administrative system, as this could be similar to existing allocation methods.

- If there were any unallocated capacity, for example because more slots could be accommodated within the new capacity when the exact traffic mix is known following the second stage of the process, this would be allocated by a follow-up process.

A ‘clock auction’ is a simple variant of a simultaneous multi round auction (SMRA) used for selling groups of multiple, identical lots. In this format, there is a common price for identical lots that increases in each round until aggregate bidder demand falls to a level where it matches supply. This format would be particularly suitable for selling scheduling rights of a small number of different types.

A clock auction is not appropriate to schedule specific air movements in a detailed manner, e.g. specific timings. We discuss the possible use of a combinatorial auction to allocate specific slots under Mechanism V. Within this Mechanism, we are using an auction solely to divide up available capacity into tranches and allocate scheduling rights accordingly, rather than determine specific slot timings.

A 2.4.1 Design of lots

Bidders bid for ‘scheduling rights’, rather than specific slots. A scheduling right will entitle the recipient to operate either a weekly take-off or landing slot on one day of the week within a broad time window, as discussed under Mechanism II. The exact day and time of the slot, and any other constraints on the type of flight that can be operated, will be determined in the second stage of the process. As in Mechanism II, the proposed categories of scheduling rights are:
Annex 2

Table 9: Proposed categories of scheduling rights

<table>
<thead>
<tr>
<th>Category</th>
<th>Timings</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>06:00-09:00</td>
</tr>
<tr>
<td>B</td>
<td>09:00-12:00</td>
</tr>
<tr>
<td>C</td>
<td>12:00-16:00</td>
</tr>
<tr>
<td>D</td>
<td>16:00-20:00</td>
</tr>
<tr>
<td>E</td>
<td>20:00-23:00</td>
</tr>
</tbody>
</table>

Prior to the auction, the airports coordinator would calculate and state the number of available scheduling rights per time window. Airlines can easily ensure that they get scheduling rights that support paired slots or other specific combinations of slots as they are bidding simultaneously for a specific number of scheduling rights of each type. Bids are made for numbers of scheduling rights at the prevailing price. If not all of these bids can be accommodated, the auction will continue and the price will rise.

A 2.4.2 Priorities

During our discussions with stakeholders, a stakeholder also proposed that “priorities” rather than scheduling rights would be auctioned in the first round. Capacity would be divided up into layers of priority, e.g. Priority 1, Priority 2, Priority 3, and Priority 4. In the second round where specific slot timings were to be allocated, there would be the same number of priorities held as there were slots available. Holders of Priority 1 tickets would get to make their specific slot request first and only once these slot requests had been fitted into the system would the specific slot requests of Priority 2 tickets be considered. Once Priority 2 requests were allocated Priority 3 tickets would be considered, and so forth.

A 2.4.3 Auction rules

The auction would proceed in multiple rounds. In order to prevent bidders from waiting until the later stages of the auction to make their bids, there would be so-called activity rules. These would require bidders to make a certain number of bids in order to maintain their eligibility to make future bids. This stops bidders ‘hiding in the grass’ and waiting until late in the process to reveal their demands.

The detailed rules for the auction are as follows:

i) The auction proceeds in multiple rounds.

ii) Before the auction, the auctioneer will announce the total number of scheduling rights available for each category, and a uniform reserve price per scheduling right for each category.

iii) Prospective bidders submit an application for a maximum number of slots that they require across all categories at the reserve price, and an associated deposit. Each bidder is assigned an initial eligibility,
based on their application. This determines the maximum number of scheduling rights that they can bid for in the first round.

iv) In each round of the auction, bidders submit bids for a number of scheduling rights in each category at the prevailing prices, such that:

- the maximum number of scheduling rights for any one category does not exceed their total eligibility in that round; and
- the aggregate of their scheduling rights across all the categories does not exceed their eligibility in that round.

v) Subject to meeting these conditions, on a round-by-round basis, bidders are free to shift their bids for scheduling rights across categories in response to changes in relative prices.

vi) If a bidder does not bid for an aggregate number of scheduling rights equal to their eligibility at the start of the round, then their eligibility in the next round will be reduced accordingly. For example, if a bidder has an eligibility of 10 in round n but only submits a bid for 8 scheduling rights, then its eligibility in round n+1 will be reduced to 8.

vii) At the end of each round, the auctioneer determines whether aggregate demand across all bidders for scheduling rights exceeds available supply:

- If demand exceeds supply, then the price per scheduled right for that category will be increased in the next round. The increment per right is determined by the auctioneer;
- If demand is less than or equal to supply, then the price per scheduled right for that category will remain unchanged in the next round.

viii) If there is a round in which demand for all scheduling rights for all categories is less than or equal to supply, then the auction will end. The remaining bidders will be allocated rights in each category at the prevailing prices.

It is possible that the auction will ‘overshoot’, i.e. demand for scheduling rights in some categories may be less than supply. This could happen if there is excess demand in one round, prices are increased in response but there is then excess supply in the following round. In this case there are two approaches for dealing with the excess capacity:

- include the unsold capacity in the third stage allocation process; or
- assign the capacity to bidders in the clock auction on the basis of bids they made at the point that they dropped eligibility.

The first solution is simpler, though the second would have some significant advantages in terms of efficiency of outcomes. In the case of the second approach, the following additional rules would be required:
i) A bidder that reduces eligibility will have the option of submitting a ‘last and final’ offer for packages of bidding rights across the various categories, based on their reduction in eligibility:

- a bidder may submit more than one (non-exclusive) package bid for scheduling rights;
- the total number of scheduling rights across all package bids may not exceed the reduction in eligibility in that round; and
- the bid amounts cannot exceed the current prices in the auction and cannot be lower than the bidders’ highest bid in previous rounds for rights in the relevant category.

ii) The option of submitting a ‘last and final’ offer will be available whenever a bidder reduces eligibility.

iii) At the end of the auction, if there is an overshoot, any remaining scheduling rights will be assigned to bidders based on their ‘last and final’ offers. The rights will be assigned to the combination of package bids across categories with the highest collective value. Bidders will pay the amount of their bids.

iv) If there is still any remaining capacity at the end of this process, this would be included in the third stage process.

The second approach may be attractive as it mitigates the risk that scheduled rights could go unsold at the end of the first stage unnecessarily or that the process could be grossly distorted by one or more bidders dropping a very large amount of eligibility late in the auction. However, one side-effect of this rule would be that some bidders may pay different prices for the same type of scheduling rights. Assuming a liquid market, it is unlikely that these price differences would be very large. Nevertheless, to avoid gross price differentials that might be perceived as unfair, it may be appropriate to set a minimum threshold for bid amounts that would be considered, based on a proportion of the closing price for rights in each category.

A 2.4.4 Participant requirements

Bidders would need to consider how many scheduling rights they would wish to purchase and their willingness to pay. They would need to consider how the number of scheduling rights they would wish to purchase might change at different prices. Given this information, bidding in the clock auction phase is simple and requires no complex strategies.

Given the outcome of the clock auction, there would be little immediate need for secondary market transactions of scheduling rights unless there were changes in an airline’s circumstances. It should not be the case that the clock auction produces an outcome that an airline is unhappy with (e.g. not getting pairs of slots, etc.) provided that airlines bid in a rational manner. Clearly if there were a significant period between the first and second stages of the allocation process, there would be more scope of changes in circumstances and consequent secondary trades.
Having won scheduling rights in the first stage, airlines would have to request detailed slot timings within the categories, submitting information about:

- day of the week, requested time and frequency;
- arrivals or departure; and
- aircraft type and number of seats;

as under the current system.
A 2.5 Mechnism V: Combinatorial auction

This mechanism compromises a single auction stage, unlike the two-stage clock auction. The auction would resolve both competing demands for capacity and the fine details of scheduling in one integrated process. It has the greatest potential to produce efficient outcomes, as a wide range of trade-offs in how capacity can be used can be considered. However, as a result it is also the most complex of the mechanisms we have considered.

The auction would be a variant of a simultaneous multiple round auction (SMRA) commonly used for telecoms licences. It would be adapted to allow bidders to build portfolios of slots and to pursue substitute portfolios without the risk of ending up with fragmented outcomes.

The auction would proceed in multiple rounds. Bidders would make bids for slots or packages of slots. At the end of each round, provisionally winning bids would be determined. Current prices would be determined for each slot, reflecting the provisional winning bids. Minimum bids for each lot the following round would be equal to the current price plus a modest increment (say 5% to 10%). The auction would proceed in rounds, with the prices of slots increasing round-by-round where there was bidding activity. All slots would remain potentially available to bidders until the end of the auction.

There would be activity rules as in the clock auction in Mechanism IV. The activity rules would ensure that there was progressive revelation of information about the value of lots, allowing bidders to modify their strategies in the light of emerging prices. For instance, this would allow bidders to decide whether to purchase peak or off-peak slots depending on the price premium for peak slots.

A 2.5.1 Description of lots in the auction

Bidders would bid for slots or packages of slots. Our initial proposal is to divide each day of the week into 15-minute time windows, though 20-minute or 30-minute windows may be alternatives that could simplify the process. These time windows resemble the sub-constraints currently used by the coordinator to smooth demand within the scheduling limits that are specified on an hourly basis.

A slot would entail a right to make an air movement of a specified type scheduled within that time window. A slot would be a bundle of rights to use runway, stands and terminal. When making a bid, a bidder would need to nominate how that slot would be used in order for the auction system to determine what demands that air movement would make on runway, stand and terminal capacity and so determine which bids could be compatibly accepted. Bidders would nominate usage factors, namely

- whether it would be a take-off or landing;
- the terminal used; and
- the size of aircraft (chosen from a menu).
Winning a slot would confer a right to use a slot within these usage factors. Where a bidder had won a slot with specified usage factors, he/she would be expected to use reasonable efforts to conform with the time window and usage factors. A penalty regime would apply to persistent transgression of the usage factors.

At any time subsequent to the auction, the holder of a slot could apply to the coordinator for modification of the usage factors. Permission would not be withheld unless it was infeasible to meet such a request given how other slots are being used. There would be a charge for each such request for relaxation of usage factors. This could be either an administrative charge or, better, related to the implied prices of runway, stand and terminal capacity established by the auction.

Slots would be tradeable on the secondary market, with the new user being subject to the same usage factors as the previous holder of the slot.

A 2.5.2 Auction rules

Making bids

Bidders would make bids for multiple packages of slots. Each package bid would stand or fall in its entirety. This mechanism would allow airlines to couple take-offs and landings and to ensure that slots mesh to allow workable scheduling. For instance, a package bid might be for a pair of take-off and landing slots at particular times on one day, or pairs for each day of the week (i.e. 14 slots).

Each slot within the package would have a nominated usage factor. Each package bid would have a financial bid associated with it.

Each individual slot would have a minimum price associated with it and each package bid would have to equal or exceed the total of the minimum prices of the component slots. Bids for particular packages would need to exceed bids made by that bidder for that package in previous rounds. Minimum bids would initially be set at some level such that there would certainly be more demand for slots than could be met.

Within each round, bidders would be able to submit multiple package bids. In order to simplify the bidding process, bidders would submit blocks of package bids that were mutually exclusive, i.e. at most one of the package bids in the block could win. This provides a simple mechanism for bidders to express demand for alternative packages of bids. For instance, a bidder might want a pair of slots at the same time each day, but be happy with a variety of different possible times. The bidder would make package bids for pairs of slots at each particular time each day. These would be a block of package bids, as the bidder would want to win at most one of these package bids.

Bidders would be able to make many blocks of mutually exclusive package bids. There would be no restriction on bids in different blocks winning. An example bid could look as shown in Figure 3 below.
### Figure 3: Example bid form for SMRA

**Bid block number**  
1

*Notes: You can submit as many bid blocks as desired. Each bid block will be considered independently of each other bid block you submit*

**Nominated usage factors**

<table>
<thead>
<tr>
<th>Aircraft type</th>
<th>[choose from drop down menu]</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Terminal preference</th>
<th>Terminal A</th>
<th>Terminal B</th>
<th>Terminal C</th>
<th>Any</th>
</tr>
</thead>
</table>

*Note: Pick only one category for each factor. The same usage factors apply to all bids within this bid block. The system would attach an expected load factor based on aircraft type.*

**Financial bids for packages**

<table>
<thead>
<tr>
<th>Package number</th>
<th>Amount of bid</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>e.g. £10,000</td>
</tr>
<tr>
<td>2</td>
<td>e.g. £10,000</td>
</tr>
<tr>
<td>3 etc...</td>
<td></td>
</tr>
</tbody>
</table>

**Specification of packages**

<table>
<thead>
<tr>
<th>Time/day</th>
<th>6.00-6.15</th>
<th>6.15-6.30</th>
<th>6.30-6.45</th>
<th>6.45-7.00</th>
<th>7.00-7.15</th>
<th>7.15-7.30</th>
<th>7.30-7.45</th>
<th>7.45-8.00</th>
<th>8.00-8.15</th>
<th>8.15-8.30</th>
<th>8.30-8.45</th>
<th>Etc.</th>
</tr>
</thead>
<tbody>
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<td>Mon</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
</tbody>
</table>

*Note: Each bid for a package within this bid block is exclusive. At most one bid from this bid block will be accepted.*

Whilst it is always possible for a bidder exhaustively to list out every possible combination of slots that they might want, the ‘block’ structure provides a simple means for bidders to express demand for slots related to
specific route plans. This makes it fairly easy for smaller airlines to participate in the process. Larger airlines that manage their slots as a fungible resource across routes would have a more complex problem in considering what alternative packages of slots they require.

Software would be provided for bidders to compile and check the bids that they wish to make. This would be particularly useful for smaller airlines with relatively simple demands. The bids would be loaded into a centralised electronic auction system.

**Provisional winners and current prices**

Once all bidders had made their bids, the auction system would determine the provisionally winning bids. These would be the set of bids of greatest value, subject to each slot being allocated at most once and at most one bid being accepted from each block.

Having determined the provisionally winning bidders, the auction system would determine current prices at the end of the round. These are prices such that:

- provisionally winning bids for packages of slots are equal to the sum of the current prices of their component lots;
- as far as possible, other non-winning bids are less than the sum of the current price of their component lots;
- prices move reasonably smoothly from round to round.

These would be determined by an algorithm within the auction system.

Current prices at the end of one round would determine the minimum bids for the following round.

Bidders would receive information about bids made in the previous round, current prices and minimum bids for the next round. Whilst it would be possible to have full transparency of all bids made, there might be some benefit in limiting the information to simple anonymous summaries of the extent to which each slot is oversubscribed.

We would expect a round of the auction to take a day. Given the large number of bids that some bidders would be making, it could take this long for bidders to digest the results of one round and make new bids. We would expect the auction system to be fairly quick in turning around the results of a round (less than an hour).

**Activity rules**

Bidders’ activity in the auction would be subject to activity rules. These are intended to ensure that bidders make bids throughout the auction, rather than waiting until close to the end.

Initially, each bidder would have a certain number of eligibility points, determined by the size of deposit placed. The number of distinct slots that a bidder may be active on in each round may not exceed the bidder’s eligibility points. For these purposes, a bidder’s activity is the sum of:
the number of slots that it is provisionally winning (initially zero); and

• the greatest number of other slots that it could win from its current bids if they were successful (i.e. the greatest number of distinct slots in any of its exclusive package bids).

Throughout the auction, each bidder would be required to demonstrate activity equal to or above some proportion of its eligibility; this proportion is the activity requirement. If the activity of a bidder fell short of the activity requirement, its eligibility would be reduced in proportionately. Initially the activity requirement might be around 70%, but would be increased through the auction up to 100%.

These rules give bidders some discretion to see how prices progress before making all of their bids. However, once the activity requirement increases to 100%, bidders need to be active on as many lots as they ultimately want to win.

There may be some need to count peak period slots more highly than off-peak slots for the purposes of calculating eligibility and activity. Otherwise, we might see bidders bidding on relatively cheap off-peak slots to maintain eligibility, only to switch back to more expensive slots towards the end.

 Provisionally winning bidders would be able to increase their bids in subsequent rounds, but would not be able to withdraw provisionally winning bids except in very limited circumstances. It is possible to allow a small number of withdrawals to aid bidders in switching their demand from one set of slots to another.

**Close of auction**

The auction would finish when there were no further bids.

In practice, it could take many rounds to reach the end of the auction. It can be speeded up by:

• starting the auction at a sufficiently high minimum bid that some excess demand is choked off;

• using a relatively large bid increment until excess demand is moderated;

• designing easy-to-use interfaces for the bidding system software.

In the event that the auction was in danger of overflowing and compromising the timetable for international coordination conferences, there would be a last and final round. Bidders would make a further round of bids and these determine the winning bidders.

**A 2.5.3 Participant requirements**

This is the most sophisticated of the five mechanisms we consider. Whilst it has the greatest potential to achieve efficient allocation, it also makes the greatest demands on participants.

Bidders would need to consider the portfolios of slots that they would like and how much they would be willing to pay for these. They would need to
compile lists of potential alternative portfolios as well. We would envisage that software would be supplied to bidders to assist with this process, but nevertheless bidders would need to undertake some work to integrate their bidding strategy with their scheduling and route planning processes.

The auction process could easily run for a month with a new round each day or maybe twice a day. Bidders would need to consider the relative prices of different slots at the end of each round and adjust their bids accordingly.

This is relatively simple for airlines (for example new entrants) bidding for a small number of slots with few interdependencies with existing slot holdings and routes.
Annex 3: Feedback from industry stakeholders

This annex summarises feedback from the UK industry stakeholders and international industry bodies with whom we had one-to-one discussions. The discussions focussed on understanding the feasibility of the five mechanisms presented as reported in Section A3.1. However, industry stakeholders also expressed general views on related points, which we report in Section A3.2.

A 3.1 Industry comments on alternative allocation mechanisms

A 3.1.1 Mechanism I: Administrative process without new entrant rule

- Many UK industry stakeholders considered that the administrative system with or without the new entrant rule could cope in the case of a significant amount of new capacity at Heathrow. Other airports were not thought to be a significant issue; the current system would work at Stansted and probably at Gatwick (as it did at Manchester).
- Two stakeholders considered that the current system would not be able to cope with the excess demand at Heathrow.
- One stakeholder was unsure whether the current system would cope and stated that it depended on how the capacity release was phased and how much excess demand there was for that capacity.
- Some suggested specific criteria could be developed to enhance the present selection process.
- Other stakeholders considered that if specific criteria were modified then it would be hard to get agreement on what the new criteria should be.
- One carrier thought that it would be hard to get agreement on removing the new entrant rule.

A 3.1.2 Mechanism II: Administrative process with business cases

- This mechanism was rejected by most stakeholders as unworkable; the business case assessment process was considered to be time consuming (for airlines and administrators), resource intensive and too subjective. In addition it was thought to be hard to enforce an airline using a slot for a specific route and aircraft type, and that if slots were allocated to specific routes this would reduce flexibility in slot trading.
- A Mechanism II “lite” was favoured by one airline as a means of allocating capacity – in particular this was favoured if it could be rolled
out in Europe to ensure greater transparency. The “lite” version would involve a system of agreed published criteria.

A 3.1.3 Mechanism III: Administrative process with set prices

- The majority of stakeholders agreed that it would be difficult (and undesirable) for an administrative body to set prices. In particular with the release of significant new capacity it would be very difficult to set prices at the correct level.
- One stakeholder was somewhat supportive as this approach was considered simpler and had transparency up front; however, they still considered that it would be hard to set prices especially under a third runway at Heathrow scenario.

A 3.1.4 Mechanism IV: Hybrid auction

- A two-stage process was thought to be feasible by some stakeholders.
- However, the three to four hour time windows suggested for each scheduling right were considered by many of the stakeholders to be too broad. A broad time window for the scheduling rights would introduce too much uncertainty into the scheduling process and it would be hard to coordinate with the other end of a route.
- One stakeholder was supportive of a simple auction process combined with an administrative second stage.
- An alternative system of purchased priorities was suggested by one stakeholder.

A 3.1.5 Mechanism V: Combinatorial Auction

- The majority of stakeholders considered this method to be too complex for bidders to participate in and there was some concern that winner determination was a ‘black box’, i.e. that it is not immediately apparent to bidders how a computer algorithm determines winning bid.
- One stakeholder suggested that the complexity of the slot allocation problem at London Heathrow may warrant this type of auction, but that it was too complex for other airports.
- A stakeholder, who was in favour of auctions, stressed that it would be difficult for airlines to make conditional package bids in a combinatorial auction and that auctioning scheduling rights in a two-stage process would reduce the number of combinations that airlines have to consider in forming their bid strategy.
A 3.2 Other issues raised by industry stakeholders

A number of stakeholders pointed out that for them, the question of alternative mechanisms is interrelated with a number of other issues such as who owns slots and who would receive any revenue generated by allocation of new capacity. For completeness, we summarise the more general points made in this subsection.

A 3.2.1 Issues related to ownership of slots

• Who can bid in an auction? Concern that if, for example banks could own slots this would reduce trading and swapping flexibility.
• What happens to the revenue generated? If this is not used to reduce airport charges then airlines would be paying twice for airport access.
• Would the 'use it or lose it' rule still apply to slots that have been purchased?
• How would slot capacity be defined? Slots on a new runway at Heathrow could be specifically for short haul operations and may also be terminal specific.
• Most stakeholders thought that usage rights should be grandfathered to keep the process simple and to allow maximum slot swapping and trading flexibility.

A 3.2.2 Competition issues

• Why should UK operators have to pay for slots when competitors at Paris and Frankfurt may not?
• If foreign airlines were made to pay for slots at London Heathrow, there may be reprisals on UK airlines at the other end of the route.
• Short haul operators were concerned they would be priced out of London Heathrow.
• Auctions may be a disincentive for airlines to start flights to UK airports.
• One stakeholder considered that auctions would only work if no airlines receive state aid.

A 3.2.3 General points raised by industry stakeholders

• General comment that the existing process works very well and that ACL operates in the overall best interests of the industry. Most industry stakeholders do not believe that auctions are required.
• A key issue is to maintain current flexibility and avoid any process that impacts on trading, swaps or slot sitting.
• There was general support for reform of the new entrant rule at all airports – either by reducing the requirement or by removing it altogether.

• Alternative mechanisms were considered to be primarily a Heathrow issue, although Gatwick also faces significant scheduling challenges.

• Integration with the IATA slot allocation process is key.

• Some airlines suggested that new capacity should be allocated to similar timescales as the current IATA process. However, a couple of airlines suggested that additional time (around 18 months to two years) to procure aircraft and crew would be beneficial.

• Some UK airlines expressed concern regarding lack of transparency in how some EU coordinators apply the current process and that this needs to be considered for alternative mechanisms.

• How would the slot pool integrate into the process? What would be the definition of “new” capacity?
Annex 4: Understanding bargaining inefficiencies

353. The fundamental difference between secondary trading and auctions can be seen by developing a simple example:

- Suppose that there is a single slot pair available to two potential buyers, call them $A$ and $B$.
- Neither potential buyer knows what the slot is worth to the other, but suppose that each conjectures that it is worth somewhere between £0 and £10m to the other.

354. Consider first an administrative process for primary allocation. This could either be an allocation process based on applying particular rules or even a lottery. It is reasonable to assume that the seller of the slot has similar information about the willingness to pay of the users as the users have about each other.\(^{55}\) This means that the seller knows that each is prepared to pay somewhere between £0 and £10m, but does not know which of $A$ and $B$ has a higher valuation. Therefore, the seller cannot simply award the slot to the highest value user because there is no way of telling who this is.

355. For the sake of argument, suppose that the slot was awarded to $A$. This will be an efficient outcome if $B$ values the slot less. However, if $B$ values the slot more than $A$, there is potential for mutually beneficial secondary trade. There will be prices at which $A$ will be prepared to sell and $B$ is prepared to buy. The greater the difference between valuations of $A$ and $B$, the greater are the benefits from secondary trading (the so-called ‘gains from trade’).

356. Where there are potential benefits from trading, $A$ and $B$ first need to identify each other as possible trading parties. How difficult this might be depends on:

- how many slot holders there are who might be potential sellers;
- how many potential buyers there are;
- the organisation of the secondary market.

357. In general, there could be significant problems in $A$ and $B$ identifying each other as potential trading parties. We return to this issue subsequently, but for now make the optimistic assumption that $A$ and $B$ have identified each other. The next step is for them to agree a price.

\(^{55}\) In practice, the seller might not have as good information about the valuations of the buyers than the buyers have about each other. Therefore, our assumption that the seller has similar information is optimistic.
358. Let us say for the sake of argument that A values a slot at £4m, whereas B values the slot at £6m. Therefore, there is £2m of potential gains from the trade, which will be split between the two parties according to the price they agree. For example, a transaction price of £5m splits the gains equally between the two parties.

359. From A’s perspective, it wishes to secure a price higher than £4m and believes that B’s valuation could be anything up to £10m. Therefore, it is likely to push for a price significantly higher than £4m. Demanding a higher price results in greater surplus for A if a sale is achieved, but reduces the likelihood of B accepting its offer. A will need to trade off these considerations in determining its bargaining strategy. B has analogous, but opposite, incentives. It wishes to achieve as low a price as possible below £6m.

360. In this bargaining situation, neither party knows the valuation of the other party; there is imperfect information. Therefore, there is a danger that they will make incompatible demands. A may try to push the price up and B push the price down in attempts to capture a larger share of the overall benefits of the transaction. This incentive to capture the benefit leads to the possibility that the parties may fail to agree.

361. Typically, the seller will only accept offers that exceed its valuation on the slot by a sufficient amount. For example, if A values the slot at £4m, then given its beliefs about B’s possible valuations and bidding strategy, it may decide not to accept offers less than £5m. This means that if B had a valuation in the range £4m to £5m, no transaction would occur, even though it would be efficient to trade. The same considerations apply from B’s perspective. Where the two parties are seeking to achieve surpluses that sum to more than the gains to trade from the transaction, this cannot be accommodated.

362. This informal argument demonstrates that where gains to trade are small, the transaction may fail to occur. Only where the gains to trade are sufficiently large will there be enough benefit to split between the buyer and seller to make them both content to trade. For example, if A had a valuation of £4.9m and B had a valuation of £5.1m, there is a much narrower range of possible prices at which both parties will be willing to transact. In this case, there may be insufficient overall benefit from trading to accommodate the surplus that each party is seeking to obtain from the transaction.

363. We can summarise the situation in Figure 4. It is efficient for the slot to be sold by A to B whenever B places a higher value on the slot than A.

Therefore, the situations where trade is efficient lie above the diagonal (shown in colour. However, where the difference between valuations is small, this will be insufficient for trade to occur, even though \( B \) has a higher value than \( A \) (shown as yellow). Where the difference between valuations is sufficiently large, there will be sufficient surplus for trade to occur (shown as green).

**Figure 4: Trading possibilities**

364. The fact that there are situations in which it would be efficient for \( A \) to sell to \( B \) and yet trade does not occur means that secondary trading based on bilateral bargains will not yield fully efficient outcomes. There are many real world examples of bargaining inefficiencies. For example, the housing market generally operates on the basis of bilateral bargains between buyer and seller. Often these fail to conclude because one side is trying to increase its surplus.

365. Auctions can achieve more efficient outcomes than secondary trading can alone. Instead of allocating the slot to \( A \) and allowing secondary trade to occur where \( B \) values the slot sufficiently more than \( A \), suppose that an auction was conducted. With a simple open auction, if the price was less than the willingness to pay of both \( A \) and \( B \), then both would make bids and the price would rise. The price would continue to rise until one of the two potential buyers dropped out. Clearly it is never rational for a potential buyer to drop out at less than its willingness to pay. Therefore, the highest value buyer wins the slot, at a price determined by the willingness to pay of the other buyer.
366. The auction achieves an efficient outcome even in situations where secondary trading would have failed to achieve an efficient outcome. For example, suppose that $B$ values the slot a little more than $A$. If the slot were allocated to $A$ using an administrative process, the gains to trade may not be sufficient for secondary trade to occur. However, using an auction for primary allocation would lead to the slot being allocated to $B$ in the first instance.

367. We can also see from this example that if there were a large inefficiency in primary allocation, we can expect the secondary market to resolve this, as there would be large gains to trade. Therefore, although there is a benefit of auctions over other primary allocation methods in the presence of secondary trading, this is self-limiting. Nevertheless, the benefit could still be considerable, as we discuss in Section 10.
Annex 5: Methodology for estimation of benefits of an auction

A 5.1 Efficiency benefit of auctions relative to administrative allocation

368. We first estimate the potential efficiency benefit for using an auction to allocate slots rather than an administrative allocation. We focus primarily on the case of allocation of a representative single slot (as this is tractable to analyse), then subsequently discuss what this approach tells us about the simultaneous allocation of many slots.

A 5.1.1 Inefficiencies unresolved by secondary trade

369. We assume that secondary trading is possible, but that it would operate through bilateral negotiations. In particular, we assume that trading volumes are insufficient to allow a centralised and intermediated secondary market where multiple buy and sell requests can be matched by a market maker or through an automated process. In our base case, the secondary market would be subject to bargaining inefficiencies of the type discussed in Section 3.3.2, but no other inefficiencies. In particular, this assumes that there is no legal uncertainty around secondary trading, so arguably this better corresponds to a hypothetical situation following new Slot Regulations that formalised secondary trading, rather than the current situation.

370. Clearly the relative efficiency of using an auction will depend on how effective the administrative allocation process is in identifying the most efficient users of slots. Given that the administrator has little information about the relative willingness to pay of different users, there is no guarantee that the most efficient user will be selected. In the worst case, where the administrator has no information whatsoever about the willingness to pay of different potential users, the allocation process may be little better than holding a lottery. However, this may be an overly pessimistic assumption, since often the administrator will have some information about how potential users might use a slot and may be able to filter out those with particularly weak cases for using the slot.

371. In line with our approach of making conservative assumptions that, if anything, underestimate the benefits of auctions, we suppose that in fact the administrator had quite good information to choose between competing users and can get fairly close to achieving an efficient outcome. In particular, we suppose that:

- the administrative system is able to filter out all but the two potential users with highest willingness to pay (in particular, that it is common knowledge who the two strongest potential users are); and
of the two potential users with highest willingness to pay, the administrative allocation awards the slot to each potential user with equal probability (so there is a 50% chance that the slot will not be awarded to the user with highest overall value).

372. This seems to significantly understate of the complexity of allocating a peak time slot at a highly congested airport such as Heathrow. There could be many potential users of the slot and the administrator might need to decide between these without necessarily being able to identify the two potential users with the highest willingness to pay.

373. In the event that the slot is inefficiently awarded, secondary trading may rectify this. Given that we are assuming it is common knowledge who the two strongest potential users are, there should be no difficulty for the seller of a slot to identify the potential buyer. Therefore, we have assumed away the problem of search in secondary markets. However, the two parties may still fail to agree a price at which both are willing to transact even if it is efficient for them to do so. A summary of the possible outcomes is shown in Figure 5.

374. We assume that where secondary trade occurs, there are no delays and it occurs immediately subsequent to primary allocation. Again, this is a rather optimistic assumption.

**Figure 5: Summary of allocation possibilities**

- **Identity of two potential users with highest WTP**
  - Common knowledge amongst slot administrator and potential users
- **Administrative allocation**
  - 50% Slot given to user with highest WTP
  - 50% Slot given to user with second highest WTP
- **Secondary trade**
  - Secondary trade fails
  - Secondary trade succeeds
These assumptions are highly conservative. By assuming that it is common knowledge who the two highest value users are, we dramatically reduce the scope for inefficient allocation. For example, suppose instead that it was common knowledge who the three strongest potential users were. In this case:

- the probability of the administrative allocation picking the highest value potential user drops to one-third;
- there is an additional problem with secondary trading as the potential seller of a slot can identify two potential buyers, but will not know which of the two has highest value.

This alternative gives a substantially greater chance of inefficient allocation as compared with our base case.

By assuming that there is common knowledge of the identities of the two strongest potential bidders, we are supposing that there is much richer information available to effect efficient allocation than is likely to be the case in practice. Therefore, we are being very optimistic indeed about the effectiveness of administrative allocation followed by secondary trading.

Given these assumptions, we can estimate the average efficiency of the administrative allocation procedure. We apply the Myerson-Satterthwaite model to calculate the likelihood of efficient secondary trade in the event that the administrative allocation is not efficient. We assume that:

- both buyer and seller have uniformly distributed valuations between zero and some common upper bound\(^{57}\);
- there are no transactions costs or impediments to trade other than bargaining inefficiencies.

We make the assumption of uniformly distributed uncertainty about valuations primarily for technical reasons, as it is possible to solve the Myerson-Satterthwaite model explicitly in this case. This has been used in other assessments of secondary market efficiency, notably by Ofcom.\(^{58}\)

The assumption of no other transactions costs or impediments to trade is again a conservative assumption. In practice, there may be significant transaction costs, for example arising from legal work or due diligence.

---

\(^{57}\) Strictly, we should consider the distribution of valuations conditional on \(A\) and \(B\) being the two highest valuation bidders. For simplicity, we are assuming that the posterior distribution of valuations conditional on this information is uniform.

\(^{58}\) See for example Annex B of the RA/Ofcom joint consultation on spectrum trading (2003). The Myerson-Satterthwaite result was used for assessing the benefits of allowing secondary trading.
Also, potential trading parties may take time to identify each other or may even fail to do so at all (i.e. there may be search costs).

380. Given these assumptions, we can describe the potential for secondary trading and calculate the average efficiency of the administrative process. Suppose that user A is awarded the slot and that user B is the other potential user (this is just a labelling convention to refer to the two users). Let \( v_a \) be the willingness to pay of user A and \( v_b \) be the willingness to pay of user B. By assumption, A and B have the two highest willingnesses to pay for slots, but either A or B may have the overall highest willingness to pay. We can illustrate the various possible outcomes in Figure 6:

- where \( v_a > v_b \) (lower right grey area) the administrative allocation process directly awards the slot to the user with highest willingness to pay;
- where \( v_a < v_b \) (upper left blue area and white band) the administrative allocation process does not award the slot to the user with the highest willingness to pay, so efficient allocation relies on secondary trading.

381. Where the administrative process fails to achieve efficient allocation, there are two possible outcomes. If there is a sufficiently large gap between the valuations of the buyer and seller, then secondary trade will occur (upper left blue area). However, where the gap between valuations is small, efficient trade will not occur (white band). Given the assumption of a uniform distribution for valuations:

- Myerson and Satterthwaite show the efficient bargaining mechanism that maximises overall gains to trade (and does not involve a third party) leads to transfer of the slot if and only if the buyer’s valuation (\( v_b \)) exceed the seller’s valuation (\( v_a \)) by 25%. Therefore, this result imposes an upper bound on the efficiency we can expect regardless of the nature of bargaining process.
- A related result by Chatterjee and Samuelson has shown that a simple bargaining process can achieve this upper bound.

382. Therefore, we suppose that where \( v_a < v_b < v_a + 1/4 \), there will be an inefficient outcome. Again these outcomes are illustrated by the white band in Figure 6.
383. We measure the efficiency of outcomes as the ratio:

\[
\frac{\text{Value to user awarded slot}}{\text{Maximum achievable value of slot to highest value user}}
\]

Therefore, where a slot is allocated to the highest value user, efficiency is 100%. Efficiency below 100% represents a potential for gains to secondary trade, in that the slot is not currently allocated to the highest value user.

384. On an ex-ante basis, any of the possible outcomes in the square shown in Figure 6 are equally likely to occur given our assumptions. We wish to calculate the average efficiency of outcomes given these various possible valuations. There are three possible cases we need to consider:

- the case \( v_a > v_b \) (the lower right grey area) occurs with probability \( \frac{1}{2} \) and achieves efficiency of 100% due to the administrative process awarding the slot to the highest value user;
• the case \( v_a < v_b < v_a + 1/4 \) (the white band) occurs with probability 7/32 and does not achieve full efficiency through secondary trading. Efficiency is \( v_a/v_b \), which on average equals about 70% over this region\(^{59}\),

• with probability 9/32, \( v_a + 1/4 < v_b \) (the upper left blue area) and achieved efficiency is again 100% due to successful secondary trading.

385. Therefore, we can calculate the expected level of achieved efficiency by taking a probability-weighted average across all these possible cases. It can be shown that the average level of efficiency is about 93% across all the possible cases. Therefore, there is a 7% efficiency loss under these assumptions. This is our base case assumption.

A 5.1.2 Mismatch between buyers and sellers

386. Again, it is important to emphasise that the assumptions made here are conservative. In particular we are assuming that there are no other impediments to secondary trading. For example, as an illustration, suppose that \( A \) and \( B \) did not necessarily automatically identify each other as potential trading partners and that there was a probability of a ‘mismatch’ in the case that secondary trade was needed. The situation is as shown in Figure 7.

\(^{59}\) It can be shown that the average value of \( v_a/v_b \) over this region is equal to \((7-2 \ln 2)/8\).
Figure 7: Outcomes with possible failure to match buyer and seller

Administrative allocation

Slot given to user with highest WTP

Slot given to user with second highest WTP

Efficient outcome

Counterparty found

Bilateral bargaining

Mismatch

Secondary trade succeeds

Secondary trade fails

Efficient outcome

Inefficient outcome

Here there is a significant reduction in efficiency relative to the base case. Table 10 recalculates average efficiency in this case given a certain mismatch probability. Notice that even in the case that buyer and seller never find each other \((m=100\%)\), efficiency is still 75% under our conservative assumptions, as half the time the slot is given to the highest value user and half the time to the second highest value user, whose valuation will on average be half the valuation of the highest value user. We still obtain this level of efficiency due to the strong assumption that the administrative process can identify the two highest value users.
Annex 5

Table 10: Average efficiency when buyer and seller may not be matched

<table>
<thead>
<tr>
<th>Probability of mismatch</th>
<th>Average efficiency</th>
</tr>
</thead>
<tbody>
<tr>
<td>0%</td>
<td>93%</td>
</tr>
<tr>
<td>10%</td>
<td>92%</td>
</tr>
<tr>
<td>20%</td>
<td>90%</td>
</tr>
<tr>
<td>50%</td>
<td>84%</td>
</tr>
<tr>
<td>70%</td>
<td>81%</td>
</tr>
<tr>
<td>100%</td>
<td>75%</td>
</tr>
</tbody>
</table>

388. As an alternative to our base case, we also carry forward an alternative scenario in which there is a mismatch probability of 50%, i.e. there is an equal chance that buyer and seller will match. In this case, there is a 16% efficiency loss, a little more than double our base case. This could also be interpreted as an efficiency loss due to transaction costs.

A 5.1.3 The case of many slots

389. In contrast, this simple example of allocation of a single slot through an auction can be expected to be fully efficient under the assumptions we have made above. For example, a simple open auction of the slot would lead to the slot being allocated to the user with highest willingness to pay.

390. Although this is a highly stylised example, it demonstrates that even in the simplest possible circumstances there is a significant difference in the efficiency that an auction can achieve and what secondary trading can achieve. If we start to consider the added complexity that is likely in a real world setting, there are good reasons to expect the differences between administrative allocation and auctioning to be even greater than the 7% efficiency loss estimate of our base case:

- In practice, the administrator might not be able to identify the two potential users with highest willingness to pay. The efficiency loss from administrative allocation would be much greater in this case, though it is difficult to estimate without detailed specification of the information available to the administrator. Therefore, we do not develop this scenario.

- Where many slots are allocated, rather than a single slot, there is a substantial increase in the difficulty of achieving an efficient allocation through the administrative system, as it is necessary also to consider whether slots are substitutes or complements for users. Therefore, we would expect a relatively greater role for secondary trading when considering the allocation of multiple slots in a simultaneous process. However, secondary trading itself becomes more complex once there
are multiple lots in play. For example, a buyer may need to engage with more than one seller to acquire the combination of lots it needs. In contrast, a well-designed auction can allow bidders to pursue substitutes and complements. For example, simultaneous multiple round auctions, combinatorial auctions and other designs have been developed specifically to achieve reasonably efficient allocation in the presence of substitutes and complements. Therefore, there is good reason to expect that the comparative benefit of auctions relative to administrative processes will be greater when multiple lots are being awarded.

391. These factors suggest that the benefit of auctions relative to administrative allocation processes are likely to be greater than our estimate. However, estimating this benefit when many slots are involved is not amenable to theoretical modelling; rather, an experimental approach would be more appropriate. Therefore, we take the likely inefficiencies in the single slot case under optimistic assumptions about the information available to the administrator as a conservative lower bound on the likely inefficiencies in practice.

A 5.2 Decay over time of the efficiency benefits of primary allocation

392. So far we have seen that the use of auctions can bring benefits relative to using administrative allocation relying on secondary trading due to inherent inefficiencies in secondary trading. However, we must also recognise that we cannot expect the efficient allocation of slots to remain unchanged over time, with the initial primary allocation fossilised in place. Rather, there will be changes in the circumstances of airlines that may lead to secondary trading, as the highest value user of a particular slot today may not be the highest value user in the future.

393. Therefore, changing circumstances produce some churn in slots over time. This means that the initial primary allocation of slots will become increasingly less relevant. For example, suppose that airlines’ valuations of slots five years after initial allocation bore little relationship to their initial valuations. In this case, the efficiency of the initial allocation would have little bearing on the current efficiency of slot use.

394. This means that any benefit of an auction over and above secondary trading depreciates over time. The faster different airlines’ valuations change relative to one another, the faster will the relative efficiency benefits of using an auction be eroded.

395. In order to assess the speed at which the efficient allocation of slots is likely to change, we can look at existing volumes of secondary trading at congested airports. Clearly secondary trading may reflect:

- adaptation by airlines to change circumstances; and
- correction of any inefficiencies in primary allocation.
For example, when secondary trading was allowed for the first time at US airports, there was an initial pulse of trading as initial inefficiencies were rectified, with trading volumes then dropping to a lower on-going level reflecting the need for trading to adapt to changing circumstances.

396. Secondary trading as a result of inefficient primary allocation of new slots is only a major issue if there is allocation of significant new capacity. If we take Heathrow as a benchmark, although there has been some modest incremental growth in capacity, there has not been any allocation of significant new capacity. Therefore, we can take existing levels of secondary trading as being motivated by changing circumstances, rather than the need to fix inefficiencies in primary allocation. Table 2 shows that recent secondary trading volumes at Heathrow have been about 1.5% per annum in recent years (post 9/11). However, it could be that legal uncertainty is impeding secondary trading and that a firmer legal basis for slot trades would increase trading volumes. Therefore, we also investigate the possibility that the turnover of slots through secondary trading increases to 5% per annum. This rate of secondary trading is higher than that envisaged in the NERA report.\(^{60}\)

397. The next question is how to interpret secondary trading volumes. If airlines’ valuations of slots change, the Myerson-Satterthwaite model suggests that secondary trade will only occur if the potential buyer’s valuation exceeds that of the seller by a sufficient amount. Therefore, not all movements in valuations will lead to secondary trades, even if they may create inefficient allocations.

398. We use the following stylised model to interpret the rate of secondary trading. We suppose that:

- each year there is a probability, \(r\) that the valuations of the highest and second highest value users change and are redrawn from the uniform distributions assumed above; and
- the highest and second highest value users may swap places, but they remain the top two.

399. Where users adjust their valuations following an initially efficient allocation of the slot, there are three possible outcomes:

- the identity of the highest value user remains unchanged, which happens with probability \(\frac{1}{2}\);
- the previously second highest value user becomes the highest value user, but the difference in valuations is insufficient for secondary trade

\(^{60}\) NERA, “Study to assess the effects of different slot allocation schemes”, A final report to the European Commission, DG TREN, January 2004.
to occur. Using the Myerson-Satterthwaite model with the assumptions made above, this situation occurs with probability 7/32; and

- the previously second highest value user becomes the highest value user and the difference in valuations is sufficient for secondary trade to occur. This occurs with probability 9/32.

400. This means that starting from an initially efficient situation, we will observe secondary trade in any given year with probability 9r/32. A previously efficient initial allocation (as would result from any auction) would decay into an inefficient allocation with probability 7r/32. Therefore, the benefits of an initially efficient allocation decay at a rate equal to 7/9 times the rate of secondary trade (which we take at 1.5% per annum in our base case and 5% per annum as an alternative).

401. This calculation applies to a situation where the allocation is initially efficient. If this is not the case, we to bear in mind that initially inefficient allocations could become efficient due to changes in the valuations of users. For simplicity, we do not take this effect into account. This leads to a modest overstatement of the rate at which the efficient allocation becomes increasingly inefficient over time. Therefore, again we are calculating a lower bound on the benefits of efficient initial allocation.

A 5.3 Economic value of aviation

402. We take as our starting point the 1999 Oxford Economic Forecasting (OEF) study\(^\text{61}\) on the economic benefits of aviation to the UK economy. This is the most recent available study.

403. OEF estimate the value from aviation by looking into a wide range of categories of benefit, including:

- the direct GDP contribution of aviation, including its direct value-added, the employment it generates, and the contribution of aviation related services, including tourism;

- its financial contribution to profits, taxes and the balance of payments;

- the consumer surplus of those purchasing air transport; and

- its impact on other sectors, UK productivity and economic growth.

404. The allocation mechanism is likely to have a direct impact on the value-added of airlines. Differences in airlines’ willingness to pay for slots directly represent differences in their anticipated value-added, i.e. their revenues less cost of inputs. For example, a 10% increase in value-added represents

a 10% increase in willingness to pay for slots. A more efficient allocation of slots would result in slots being allocated to airlines who could generate greater value-added. Therefore, a 10% increase is slot allocation efficiency (as defined above) would be associated with a 10% increase in value-added in the aviation industry.

405. Consumer surplus is very likely to be affected by slot misallocation. Differences in willingness to pay for slots are likely to be associated with differences in the attractiveness of services to end customers, rather than sustained differences in costs. In the long-run, all airlines effectively operate with similar technologies and with a similar cost base. We assume that changes in the efficiency of slot allocation produce a change in consumer surplus that is proportionate to the change in value-added in the aviation industry, assuming the same relationship between value-added and consumer surplus as that used by OEF.

406. For the purpose of estimating the impact of slot allocation, we concentrate only on the most direct economic contribution of aviation, specifically:

- the value added by airlines,\(^{62}\) i.e. the total output by airlines minus the input costs; and
- the consumer surplus enjoyed by aviation customers.

407. We suppose that other categories of economic benefits would be unaffected by slot allocation or else can be ignored where they are difficult to estimate. In particular:

- we suppose that the economic output of suppliers to the aviation industry is unaffected by slot allocation, as many of these inputs would still be required regardless of how slots were used; and
- we do not take account of any knock-on effect on UK economic growth or wider benefits, though arguably there could be effects on these categories of benefits due to slot allocation if more efficient slot allocation allowed services to better match consumers’ needs.

408. The efficiency gains from using auctions for primary allocation would only be achieved at airports where capacity is significantly scarce and where competing demands for slots need to be resolved. As an illustrative example, we consider the potential benefit of a capacity increase at Heathrow due to a move to mixed mode. For this reason, we need to identify the proportion of total airlines’ value-added and consumer surplus that can be ascribed to Heathrow in particular.

\(^{62}\) In the OEF study, these are defined as companies with standard industry classification (SIC) 62.
A 5.3.1 Proportion of the economic value from aviation generated at Heathrow

409. Airport statistics show that in 2005, 29.7% of passengers at all UK airports passed through Heathrow. Clearly passenger numbers are not necessarily a good reflection of the relative economic contribution of different airports. Nevertheless, it is reasonable to expect the contribution of Heathrow to be proportionately greater than traffic numbers would suggest, as Heathrow amounts for a greater share of high-value services. For example as shown in Table 11, in 2004, more than 60% of terminating international business passengers at coordinated UK airports came into Heathrow airport.

**Table 11: Survey of terminating passengers (000s) at main UK airports in 2004**

<table>
<thead>
<tr>
<th>Airport</th>
<th>UK Business</th>
<th>International Leisure</th>
<th>Domestic Business</th>
<th>Domestic Leisure</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>UK Foreign</td>
<td>UK Foreign</td>
<td>UK Foreign</td>
<td>UK Foreign</td>
<td></td>
</tr>
<tr>
<td>Gatwick</td>
<td>1556</td>
<td>1247</td>
<td>17098</td>
<td>3862</td>
<td>26536</td>
</tr>
<tr>
<td>Heathrow</td>
<td>8164</td>
<td>6905</td>
<td>14791</td>
<td>9879</td>
<td>43615</td>
</tr>
<tr>
<td>Luton</td>
<td>648</td>
<td>351</td>
<td>3533</td>
<td>1010</td>
<td>7053</td>
</tr>
<tr>
<td>Manchester</td>
<td>1373</td>
<td>846</td>
<td>12748</td>
<td>1499</td>
<td>19462</td>
</tr>
<tr>
<td>Stansted</td>
<td>1503</td>
<td>1033</td>
<td>8885</td>
<td>4599</td>
<td>18283</td>
</tr>
<tr>
<td>Total</td>
<td>13244</td>
<td>10381</td>
<td>57061</td>
<td>20845</td>
<td>114948</td>
</tr>
<tr>
<td>% at LHR</td>
<td>62%</td>
<td>67%</td>
<td>26%</td>
<td>47%</td>
<td>38%</td>
</tr>
</tbody>
</table>

Source: CAA Survey 2004 Table 04

410. In the absence of any other reliable data, we suppose conservatively that 30% of the UK economic contribution of aviation estimated by OEF can be ascribed to Heathrow, considering 40% as an alternative assumption.

A 5.3.2 Growth of economic value from aviation at Heathrow

411. OEF assumes that there is significant growth in the economic contribution of aviation over time. From 1998 to 2015, the value-added of the aviation industry grows at an average of 3.9% per annum. This is significantly faster than likely GDP growth and reflects an extrapolation of previous growth in air traffic and passenger numbers. However, this sustained trend could only be accommodated with some increase in future airport capacity. Therefore,

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63 UK Airport Statistics - 2005 Annual - Table 01
the overall trend is due in part to economic growth and in part to anticipated future capacity.

412. For this reason, the growth of the economic value from aviation in congested airports might be lower without capacity increases, due to congestion effectively limiting the potential to further increase capacity. Therefore, we assume that unless there is a capacity increase at Heathrow, the value-added generated at this airport would grow at a slower rate of 2% per annum from 2006, in line with likely long-run economy-wide economic growth for the UK.

413. The forecasts provided by OEF suggest that growth in consumer surplus will be significantly greater than the growth in airlines’ value-added. Therefore, in order to calculate the impact of the capacity increase on consumer surplus, we examine the correspondence between value-added growth and consumer surplus growth used by OEF. Specifically, OEF assumes that the ratio of consumer surplus growth to value-added growth is 1.4. Thus, we estimate the consumer surplus at Heathrow to grow at 1.4 times the rate of the airlines’ value-added. Using this approach, the consumer surplus at Heathrow is assumed to grow, in the absence of a capacity increase, at 1.4x2%=2.8% per annum.

A 5.4 Impact of allocation method on economic contribution of new capacity

414. We suppose that new capacity would allow a sustained 10% increase in traffic. For our base case, we assume this capacity increase would take place in 2006; we also consider the more plausible scenario of capacity being increased in 2010, when the base level of economic benefits from aviation to which the capacity increase would apply would be greater.

415. As we wish to consider specifically the potential economic contribution of new airport capacity, we take airlines’ value-added and consumer surplus from aviation users as estimated by OEF for 2006 and 2010. This is summarised in Table 12. Using our assumptions that 30% (40%) of this value can be ascribed to Heathrow, we obtain our estimates of the value-added and consumer surplus from airlines at Heathrow.

\[
\text{Table 12: OEF forecasts of economic value of aviation in the UK}
\]

<table>
<thead>
<tr>
<th></th>
<th>2006</th>
<th>2010</th>
</tr>
</thead>
<tbody>
<tr>
<td>Value-added of aviation (£bn in 2006 prices)</td>
<td>8.7</td>
<td>10.1</td>
</tr>
<tr>
<td>Consumer surplus from aviation (£bn in 2006 prices)</td>
<td>10.4</td>
<td>12.8</td>
</tr>
</tbody>
</table>

416. We then calculate the impact of:
• a 10% capacity increment at Heathrow on the airlines’ value-added and consumer surplus generated at Heathrow, assuming the new capacity was allocated using an administrative allocation with consequent inefficiencies as estimated above; and

• using an auction mechanism instead of an administrative allocation on value-added of airlines and on consumer surplus.

A 5.4.1 Impact of capacity increase on value-added and consumer surplus

417. We assume that, if the new capacity were allocated using an administrative allocation method as used to date, the increase in capacity would translate into a proportionate increase in the value-added from airlines. Therefore, a 10% capacity increase at Heathrow results in a 10% increase in the airlines’ value-added generated at Heathrow.

418. In practice, there could be an increase in competition following the release of new capacity. This could lead to some value-added being translated into even greater consumer surplus as price-cost margins narrow. For simplicity, we have not taken such a possibility into account given that the capacity increase we are considering is small, but significant.

419. Applying the relationship between consumer surplus growth to value-added growth ratio calculated from OEF forecasts, we estimate that the impact of the capacity increase on consumer surplus is an increase of 14%.

420. In our base case, we assume that the increase in capacity takes place in 2006, and thus apply these effects to the base value-added and consumer surplus estimates for 2006. For our alternative scenario where the capacity increase is assumed to take place in 2010, we apply this increase to the value-added and consumer surplus estimates for 2010.

A 5.4.2 Calculating potential benefits of using an auction instead of an administrative allocation

421. As explained above, using an auction instead of an administrative allocation results in efficiency gains that, under conservative assumptions, may increase the value of slots to users by 7% to 16% (depending on which assumptions are used). Depreciating these gains over time to reflect the potential decay over time of the efficiency of an initially efficient allocation, we derive the year-on-year increase in the value that airlines obtain from the slots resulting from using an auction instead of an administrative allocation method.

422. We estimate the benefits from using an auction as:

• the increase in airlines’ value-added, calculated as the efficiency gains from using an auction times the value-added resulting from the capacity increase; and
• the incremental consumer surplus that results from this increase in value-added, using the ratio of consumer surplus growth over value-added growth and applying the increase to the consumer surplus resulting from the capacity increase.

We then calculate the benefits per annum for a period of 20 years from the increase in capacity, and calculate the net present value at the year in which the capacity increase takes place, using the standard HM Treasury discount rate of 3.5%. All figures are deflated to 2006 pounds.
### Glossary

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clock auction</td>
<td>A clock auction is a distinct variant of the SMRA, which is used for selling multiple, identical lots. In this format, the auctioneer announces a price at the start of each round and bidders respond how many lots they want at that price. There is a common price for identical lots that increases in each round until aggregate bidder demand falls to a level where it matches supply.</td>
</tr>
<tr>
<td>Consumer surplus</td>
<td>Consumer surplus is the economic gain accruing to a consumer (or consumers) when they engage in trade. The gain is the difference between the price they are willing to pay and the actual price they purchased the good or service for.</td>
</tr>
<tr>
<td>Downstream market</td>
<td>Downstream refer to the economic market for provision of goods and services derived from a particular input. For example, the use of airport slots is an input to the production of air traffic services, hence in relation to airport slots, air traffic services are downstream markets.</td>
</tr>
<tr>
<td>Dutch auction</td>
<td>As clock auction except prices start high and are lowered round by round until demand matches supply.</td>
</tr>
<tr>
<td>Externality</td>
<td>An externality is the effect of a transaction between two parties on a third party who is not involved in the carrying out of that transaction. Externalities can be either positive, when an external benefit is generated, or negative, when an external cost is generated from a market transaction.</td>
</tr>
<tr>
<td>PSO</td>
<td>A Public Service Obligation (PSO) is a policy instrument that can be used to provide protection for regional services, subject to strict criteria being met. Protection can be provided either by reserving slots at congested airports, or by providing subsidy for services that could not operate on a commercial basis. EC Regulation 2408/92 outlines the rules governing the use of PSOs for air services.</td>
</tr>
<tr>
<td>SMRA</td>
<td>In a Simultaneous Multiple Round Auction (SMRA), participants bid simultaneously for different lots. The auction proceeds over several rounds and after each round current winning prices for the</td>
</tr>
<tr>
<td><strong>Valued-added</strong></td>
<td>Value-added is the contribution to the economy of each individual producer, industry or sector. This is added up at macro level to calculate total gross domestic product.</td>
</tr>
</tbody>
</table>