TOWN AND COUNTRY PLANNING ACT 1990 - SECTION 77 AND TOWN AND COUNTRY PLANNING (INQUIRIES PROCEDURE) (ENGLAND) RULES 2000

APPLICATIONS BY LONDON ASHFORD AIRPORT LTD

SITE AT LONDON ASHFORD AIRPORT LIMITED, LYDD, ROMNEY MARSH, TN29 9QL

PROOF OF EVIDENCE OF MALCOLM SPAVEN MA (Hons) MSc

on behalf of Lydd Airport Action Group

PLANNING INSPECTORATE REFERENCE: APP/L2250/V/10/2131934

LPA REFERENCES: Y06/1647/SH and Y06/1648/SH

INQUIRY DOCUMENT REFERENCE: LAAG/10/A

1. Professional qualifications and experience

1.1 My name is Malcolm Spaven. I hold an M.A. (Honours) degree from the University of Edinburgh and an M.Sc in Rural and Regional Resources Planning from the University of Aberdeen. I am the principal of Spaven Consulting. Spaven Consulting specialises in assessing, and developing solutions to, the impact of aviation on the environment and the impact of planning developments on aviation.

1.2 Since the formation of the company in 1994, Spaven Consulting has carried out assessments of aircraft noise around airfields and in low flying areas, and assessments of the impacts of renewable energy developments on aviation. My clients have included wind energy developers, airports, trade associations, non-governmental organisations and community groups.

1.3 I have presented evidence to planning appeals into wind farm developments at Blinkbonny Height (1996), Little Cheyne Court (2004), Knabs Ridge (2005), Elsham (2006), Bradwell (2007 and 2009), Tween Bridge (2007), Steadings (2008), North Dover (2009), Barmoor (2009), Cushnie (2010), Cotton Farm (2010) and Hook Moor (2010).

1.4 I am a qualified pilot with a commercial pilot's licence, an instructor's rating, a night rating and an instrument meteorological conditions rating. I work as a flying instructor at Edinburgh and Fife Airports.

1.5 On behalf of gCAP Ltd I perform audits of instrument approach procedure charts for airports in the UK, Ireland and France.

1.6 I am familiar with the details of the proposed development and the development site. I have carried out analysis work on the proposed development on behalf of Lydd Airport Action Group since 2006.

1.7 I have visited the appeal site on numerous occasions. I have also flown a light aircraft in the area on several occasions.

1.8 In 2004-5 I provided evidence to the planning appeal inquiry into the Little Cheyne Court wind farm, on the subject of the potential impact of the wind farm on current and future operations at Lydd Airport.

2. Scope of evidence

2.1 In this proof of evidence, I will deal with the following matters:

- inadequacies of the aviation information provided in the planning application
- feasibility of the flight paths depicted in the airport's planning submissions
- the airport's December 2009 submissions on the subject of noise and visual impacts
- flight path assumptions in assessments made by the Nuclear Installations Inspectorate
- practical constraints on the use of Lydd Airport by commercial airliners.

2.2 In compiling my evidence I have principally used, as the reference source on the airport's proposals, the Supplementary Information submitted to Shepway District Council by LAA in March 2009, in particular:

- Volume 1: Overview of Applications and Supporting Materials submitted to Shepway District Council in respect of planning applications Y06/1647/SH and Y06/1648/SH [CD 1.38]

- Volume 3 Appendix 2: AREVA WSP Group/Lydd Airport, London Ashford Airport (Lydd) Development: Aircraft Crash Risks to Dungeness Nuclear Power Stations [CD 1.40b]

- Volume 4 Appendix 3: Chapter 16: Noise and Vibration Relating to Planning Application Y06/1648/SH (Runway Extension), March 2009, Superseding Chapter 16 of the 2006 Environmental Statement for the Runway Extension, Appendix 15.1 of Volume 3B of the 2007 Supplemental Information and Appendix 8 of the 2008 Supplemental Information [CD 1.41a]

- Volume 4 Appendix 4: Chapter 16: Noise and Vibration Relating to Planning Application Y06/1647/SH (Terminal Building), March 2009, Superseding Chapter 16 of the 2006 Environmental Statement for the Terminal Building, Appendix 15.2 of Volume 3B of the 2007 Supplemental Information and Appendix 9 of the 2008 Supplemental Information [CD 1.41b]

2.3 For the purposes of this analysis, there are no practical differences between the noise assessment for the runway extension and the noise assessment for the new terminal building. Consequently all references to Chapter 16 of the ES in my evidence are to the March 2009 revised Chapter 16 of the Environmental Statement for the runway extension [CD 1.41a].

3. Inadequacies of the aviation information provided in the planning application

3.1 There have been numerous inadequacies and inaccuracies in the aviation information presented in the airport's submissions in support of the two planning applications since 2006, and including the Supplementary Information submitted in 2007, 2008 and 2009. Some of these failings have been subsequently corrected by the airport following consultation responses from Shepway District Council and third parties including LAAG. However a significant number of inadequacies and inaccuracies remain. This section of my evidence sets these out and explains their significance for the assessment of the effects of the proposed developments on the environment.

3.2 References to the relevant paragraphs in Volume 4 Appendix 3: Community Noise Assessment (Runway Extension) (CD 1.41a) are contained in square brackets in the text below.

Baseline conditions

3.3 [16.1.2] The characterisation of baseline conditions continues to be misleading. The argument that the "baseline" should be considered to be traffic levels of 300,000 passengers a year, because that is what the current airport facilities could support, is untenable, since the actual current conditions at Lydd Airport fall well short of those traffic levels and there is no evidence of any growth towards that level of traffic.

3.4 Table 1 shows the trend in aircraft movements and passenger numbers at Lydd Airport from 2003 to 2009. The figures show that there was a reduction in traffic at Lydd Airport in this period. The period since late 2008 may be regarded as unrepresentative since this was when the economic recession began in the air transport industry. However even disregarding the figures for 2008 and 2009, there is no clear evidence of a growth trend in this period.

Table 1: Aircraft movements and passengers at Lydd Airport, 2003-2009

Year	*Total aircraft movements*	*Total air transport movements*	*Air transport movements (excluding air taxi flights)*	*Air taxi movements*	*Terminal and transit passengers (excluding air taxi flights)*
2003	25903	767	618	149	4498
2004	24268	677	595	82	4018
2005	22044	408	378	30	2817
2006	20236	482	329	153	2754
2007	24725	514	351	163	2696
2008	21488	435	263	172	1673
2009	21785	269	137	132	588

Source: CAA Airport Statistics

3.5 The period 2005 to 2009 was also a period when significant investments were made in the airport's facilities, aimed at attracting airlines to start commercial operations at Lydd. Chapter 3 of the original 2006 ES stated, in relation to the aircraft movements figures for 2005, that "at this time LAA was a visual approach airport only, but the recent investment, particularly the introduction of the ILS, has resulted in the airport being increasingly attractive to airline companies, so passenger numbers in 2006 are expected to be significantly higher."[CD 1.17, paragraph 3.5.3] In fact, passenger numbers in 2006 were 2% lower than in 2005 since the only scheduled air service from Lydd, the LyddAir service to Le Touquet, saw a 13% reduction in frequency, and no other airlines were attracted to commence services.

The role of flight path assumptions in the assessment of noise impact

3.6 All of the assessments relating to noise and other environmental impacts of aircraft using Lydd Airport are based on assumptions about the flight paths flown by those aircraft. If those assumptions are inaccurate, incomplete or unreliable, the resulting assessed impacts cannot be relied upon.

3.7 I have reviewed all of the information relating to flight paths submitted by Lydd Airport in support of their planning applications since 2006. It has been clear from those reviews that there were serious flaws in the airport's assumptions about flight paths in their original Environmental Statement in 2006, that further errors and omissions were introduced in the subsequent submissions by LAA, and that many of these flaws remain uncorrected.

3.8 The noise impact assessment carried out by LAA's consultants, as set out in the revised ES Chapter 16 of March 2009 [CD 1.41a], is based on a noise model which is constructed on the basis that aircraft types are grouped into four categories according to size. These Groups of aircraft are assessed as flying on different flight paths on departure and arrival. The cumulative impact of flights by different categories of aircraft on different flight paths is used to construct noise contours, which are then used to define the level of impact. Consequently the allocation of aircraft types to different Groups has direct consequences for the noise generated by movements of those aircraft and therefore for the construction of the noise contours.

3.9 Therefore, before addressing the reliability of the flight path information presented by LAA, I consider in the following paragraphs the validity of the LAA assumptions about the grouping of aircraft types.

Allocations of aircraft types to Groups

3.10 In the 2006 Environmental Statement [CDs 1.14 and 1.17], no details were provided of the assumptions about aircraft types on which the noise contours were constructed. In response to consultee criticism of these aspects of the ES, LAA produced Supplementary Environmental Information in October 2007 which categorised aircraft types simply into 'Commercial' and 'General Aviation' types, but provided no differentiation in terms of the flight paths flown by each.[CD 1.24c, Appendix 15.1, Appendices 4, 5 and 7]

3.11 In response to further consultee responses, LAA produced further Supplementary Environmental Information in August 2008. In Volume 7, Appendices 8 and 9 of that revised SEI [CD 1.34a], a more detailed noise assessment was presented. This retained the simple 'Commercial' and 'General Aviation' characterisation of aircraft types and the same flight path assumptions derived ultimately from the 1988 runway extension planning application [see Appendices 1 and 2]. However it was now acknowledged that "Large Aircraft" (defined as all those with a maximum take-off weight greater than 5700 kg) would have to turn right on departure from runway 21 and would not be capable of landing on runway 03 due to the location of the Lydd Range and (at that time) the lack of any instrument approach procedures for runway 03.

3.12 Finally, in March 2009, LAA produced, at Appendices 16.4A and 16.5 of a revised ES Chapter 16, a breakdown of aircraft types into four Groups, defined as follows:[CD 1.41a, paragraph 16.3.11]

- Group 1: public transport jets such as B 737, A319 (>5700kg take off weight)
- Group 2: regional public transport jets and turboprops; large executive jets (>5700kg take off weight)
- Group 3: small executive jets and air taxi turboprops (>5700kg take off weight)
- Group 4: all aircraft of less than 5700kg take off weight

3.13 This grouping of aircraft types remained the basis for the noise assessment at the time of determination of the two LAA planning applications in March 2010.

3.14 [16.3.11 and Appendices 16.4, 16.4A and 16.5] The grouping of aircraft types remains highly problematic. First, while paragraph 16.3.11 of CD 1.41a groups aircraft into four categories, it appears to include only civil aircraft types. However Appendix 16.4A includes the C-130 – a military transport aircraft – as one of the Group 2 types using Lydd most frequently for the purposes of the noise model.

3.15 Second, the tables of actual movements by different aircraft types in 2005, presented in Appendix 16.4 of the document, contain a number of anomalies which raise questions about the reliability of the data. For example:

- No movements by Trislanders are shown for the months of January and March. Since the Trislander was the only aircraft type conducting regular commercial passenger operations at Lydd in 2005, this is highly unlikely to be correct.
- There is evidence of double- or treble-counting in the table, for example variants of the PA28 are listed three times on the 4th, 5th and 6th pages of the table [see Appendix 3].

3.16 Appendix 16.4A sets out the fleet mix assumed for the purposes of the noise model. It is divided into the four groups of aircraft types set out in paragraph 16.3.11. However some of the aircraft types listed are placed in the wrong Group. For example:

- Of the 14 types listed as being in Group 3, five have maximum takeoff weights of less than 5700kg so should be in Group 4. These are the C525, BE20, L200, P180 and PC12.
- The Falcon 2000 ("F2TH") is listed as a Group 2 aircraft. However it has a similar maximum takeoff weight to the C750 which is listed under Group 3. These two aircraft should be in the same group – whether Group 2 or Group 3.

3.17 The importance of ensuring that aircraft types are correctly allocated to the four Groups lies in the different flight paths which the different Groups are assumed to fly. By including five types in Group 3 which should be in Group 4, the noise model will be underestimating the number of aircraft turning left on departure from runway 21.

3.18 [Appendix 16.4A] The figures for numbers of movements, particularly by jet types in Group 2, do not accord with those in Appendix 16.4. Taken together, the five jet types – BAe146, GLF4, CL60, ERJ135 and F2TH – are assumed in this table to be flying 47 movements a year at Lydd. However, according to Appendix 16.4, in 2005 these types only flew 12 movements at Lydd. If these incorrect figures are used as the basis for the noise model, they will be overestimating the baseline jet noise almost four-fold.

Depiction of flight paths

3.19 Even if one disregards the errors in the allocation of aircraft types to Groups in the noise model, there are additional errors and inconsistencies in the depiction of the flight paths in the ES Chapter 16.

3.20 [Appendix 16.4A, Figure 16.1, Figure 16.2] There is a mismatch between the stated flight paths used by the different Groups of aircraft in Appendix 16.4A, and those depicted on the flight path maps at Figures 16.1 and 16.2:

- Appendix 16.4A shows Group 2 aircraft only using Flight Paths 1, 4 and 6 on runway 03, whereas Fig.16.1 shows them only using FP 1, ***3*** and ***5***. [see illustration in Appendix 4]
- Appendix 16.4A shows Group 2 aircraft only using Flight Paths 7, 8, 9, 10 and 12 on runway 21, whereas Fig.16.2 shows them only using FP 7, 8, 9, 10 and ***11***.
- Appendix 16.4A shows Group 3 aircraft only using Flight Paths 1, 3, 4 and 6 on runway 03, whereas Fig.16.1 shows them only using FP 1, 3, 4 and ***5***.
- Appendix 16.4A shows Group 3 aircraft only using Flight Paths 7, 8, 9, 10 and 12 on runway 21, whereas Fig.16.2 shows them only using FP 7, 8, 9, 10 and ***11***.

Some, but not all, of these errors appear to stem from a transposition of FP5 and FP6 in the headings of the tables in Appendix 16.4A.

Modal split

3.21 The term "modal split", as applied in the context of the LAA planning applications, refers to the relative proportions of traffic which use the two runway directions – 03 and 21 – for landing and take-off. This is based on the relative distribution of wind directions at the airport, and the requirement that, in general, aircraft must land and take off into wind.

3.22 [16.3.25 to 29] The assumption of a 70/30 modal split remains problematic. While this may be broadly representative of use of the runways in 2005, it cannot be used as a predictor of future use because of the practical limitations on the use of runway 03 for landing by larger aircraft. There are three principal issues:

3.23 First, paragraph 16.3.27 suggests that Group 1 aircraft would not be able to carry out the required turning approach to runway 03 when danger area D044 is active "due to their limited turning capabilities". However no equivalent assessment appears to have been conducted of the ability of Group 2 aircraft – particularly larger and faster jet types such as the Gulfstream IV, CL600 and Embraer 135 – to carry out this manoeuvre. I address this point in detail in section 4 of my evidence, below.

3.24 Second, since the March 2009 SEI, LAA has introduced RNAV (GNSS) (satellite navigation) instrument approach procedures, including one for runway 03. This will enable the Group 1 aircraft types to land on runway 03 in instrument conditions, albeit only when the Lydd Range (D044) is inactive. Since Group 1 aircraft are assumed in the noise model to always land on runway 21, this will now be an inaccuracy in the model since these aircraft now have a means of landing on runway 03 is some circumstances.

3.25 Third, the acknowledgement that Group 1 aircraft would not be able to land on runway 03 when D044 is active raises the question of how often these aircraft would have to divert to another airport, or the flight cancelled, because the tailwind is in excess of the limit for landing on runway 21. Assumptions about diversion/cancellation rates will affect the predicted number of Group 1 aircraft using the airport. However there is no evidence of any such calculation having been made.

3.26 Table 16.1 shows that the assumed 70/30 modal split has been applied to all scenarios. However, under 'Future Assessment 300,000 ppa with runway extension', which includes Group 1 aircraft, the 70/30 balance should shift towards greater use of runway 21, because Group 1 aircraft must always land on that runway when D044 is active. The assumed 70/30 split is therefore invalid.

3.27 A further reason to question the assumption of a 70/30 split in use of the runways is that, in evidence to the 1988 Lydd Airport runway extension inquiry, the airport's noise consultant stated that the use of runways was then 80% on runway 22 (as runway 21 was then known) and 20% on runway 04 (as runway 03 was then known) "on the basis of Lydd's ATC experience".[see Appendix 5]

Use of flight paths through Lydd Range

3.28 Paragraphs 16.9.3 and 16.9.4 suggest that flight paths through the Lydd Range danger area, D044, would be available for all flights before 0830 and for at least 37% of the time during the day. This remains a highly problematic proposition. While there may be periods during the day when firing is temporarily suspended on the Lydd Range, it is understood that the Ministry of Defence is not prepared to accept flights through the range unless (a) the range has not yet commenced operations at the beginning of the day, or (b) the range has ceased operations for the rest of the day. This is clear from the Memorandum of Understanding between the Range and the Airport [CD 16.8], which states at paragraph 6.1 that Lydd Range Control will only advise the airport that the range is closed, and the airspace is therefore available to aircraft using the airport, "on a daily basis when firing has ceased and the days training activities have been concluded". The Faxed Mandate, which is the means by which such end-of-firing notifications are made, only has provision for notifying the airport of range closures which last "to 0830hrs the following day."[CD 16.9] Thus the implication in paragraphs 16.9.3 and 16.9.4 of the ES that airport operations may be able to take advantage of short periods during the day when range firing is temporarily suspended is unreliable.

3.29 I would add that, unless the airport can obtain from the MoD some form of guarantee that the range will be inactive during key periods of the airport's opening hours, no airline operator could plan regular flights into Lydd with aircraft which require the D044 range to be shut in order to make an approach to runway 03. I address this point in more detail in paragraphs 4.4 to 4.19 below.

3.30 Paragraph 16.9.5 and Figure 16.21 depict the flight paths which would be flown in the event that the Lydd Range is closed and aircraft are able to fly through the range airspace. In respect of departures from runway 21, the depicted additional flight paths are:

- FP16 for Groups 1, 2 and 3 aircraft turning right after departure;
- FP17 for Group 4 aircraft turning right after departure; and
- FP18 for all aircraft types continuing straight ahead after departure.

3.31 As regards FP16, it is not clear why, given that all Groups of aircraft are supposedly able to turn immediately right, over the town of Lydd and avoiding the D044 airspace, on departure from runway 21 when the range is active (Flight Path 11 in Figure 16.2), they would not equally choose to follow that flight path when the range is closed. Compared to FP11, the proposed FP16 would involve additional track miles, particularly for those with destinations to the north and east.

3.32 As regards FP17, this shows a very large turn radius for aircraft of less than 5700kgs. In normal circumstances these aircraft would turn right closer to the airport and would follow flight paths similar to those flown when the range is active.

3.33 The additional flight paths depicted in Figure 16.21 for arrivals on runway 03 are:

- FP13 for Group 1, 2 and 3 aircraft arriving from the north
- FP14 for Group 4 aircraft arriving from the north
- FP15 for Groups 1, 2 and 3 aircraft flying a straight-in approach over the sea.

3.34 It should be recalled that LAA constructed these flight path diagrams before the commissioning of the RNAV instrument approach procedure for runway 03. Thus all of these flight paths would only have been usable by aircraft on a visual approach, which would only be possible in the best weather conditions, particularly for larger aircraft (Groups 1 and 2, and most Group 3 types), which normally fly IFR. However, the introduction of the RNAV approach procedure in August 2009 opens up the possibility for aircraft of all Groups to make an approach to runway 03, through the D044 airspace, even when weather conditions preclude a visual approach. But FP15 does not accurately reflect the alignment of the RNAV approach, which is offset 5° to the west of the extended runway centreline. [see CD 16.3]

Flight path figures – runway 03 [Figure 16.1]

3.35 Figure 16.1 of CD 1.41a shows that an effort has been made to correct the erroneous positioning of the D044 range boundary and the R063 Dungeness Power Station restricted airspace in all previous submissions from LAA. However, the depiction of both D044 and R063 remains inaccurate, in that:

- the northern boundary of D044 is shown further south (further away from the airport) than its actual location
- the boundary of R063 is shown approximately 350 metres further north than its actual location.

3.36 These inaccuracies are illustrated in Appendix 6.

3.37 There is a mismatch between the flight paths shown in Figure 16.1 and those listed in the tables in Appendix 16.4A of the same document. These anomalies are set out in paragraph 3.20 above.

3.38 As regards Flight Path 1 (FP1), as depicted on the diagram this shows a gradual left turn over the town of Lydd followed by a much steeper left turn on to the final approach for runway 03. Group 2 and many Group 3 aircraft would have extreme difficulty flying this profile. They would be expected to fly a constant radius turn in order to give a more stable approach.

3.39 Irrespective of the depicted radius of turn, it remains highly doubtful that any commercial air transport operator would approve regular passenger-carrying operations in a Group 2 aircraft (everything up to BAe146 – 40 tonnes and 112 passengers) which required a tight circling approach to runway 03, avoiding D044 by no more than a few hundred metres. This issue is explored further in Section 4 of my evidence.

3.40 FP1 is depicted as being used by all except Group 1 aircraft types when the D044 range is active. Some of these aircraft will have initially flown an instrument approach to runway 21, to then break off when becoming visual and fly a low level circling manoeuvre to the west of the airport. These aircraft may be flying as low as 500-600 feet over Littlestone and New Romney.[1] They will therefore contribute to the noise environment to the north of the airport as well as in the vicinity of the town of Lydd. However Figure 16.1 shows FP1 as generating no noise impact beyond approximately 1km north of Lydd.

3.41 As regards FP3, there is no provision in the current en route airways structure over the English Channel for aircraft to climb out of Lydd south-eastwards towards France. Flight Path 3 would therefore only ever be an

[1] As shown on CDs , the minimum altitude for aircraft flying such a circling manoeuvre is 510ft above sea level for typical twin-turboprop airliner types and 790ft above sea level for typical jet airliner types.

option for VFR traffic such as some of the LyddAir flights to Le Touquet. IFR flights looking to climb into the en route airspace towards France would not be permitted to do so on Flight Path 3 since they would be climbing into one-way airways where all the traffic is flying in the opposite direction. FP3 is therefore not a valid flight path for commercial IFR flights.

3.42 As regards FP4, it is not clear why Group 3 and 4 aircraft are expected to fly this route, but not Group 2.

3.43 Flight Path 6 is shown as being flown by Group 4 aircraft only. However there is no reason why this flight path could not be flown by all other aircraft types. LAA is already proposing that all sizes of aircraft are capable of performing an immediate right turn on departure from runway 21 to avoid the Lydd danger area when it is active. A similar turn to the left on departure from runway 03, along FP6, would have significant noise abatement benefits for residents of Littlestone and New Romney in particular. It is not clear why LAA has not proposed this.

3.44 Flight Paths 3, 4, 5 and 6 apply to departures from runway 03. However the basis for these different flight paths is not clear. For Group 4 aircraft departing to the north west (Flight Path 6), the aircraft climb straight ahead for approximately 800 metres before turning left. However for all other runway 21 departures (Flight Paths 3, 4 and 5), the turn is not commenced until some 1500 metres beyond the departure end of the runway. While this may be explained by Group 4 aircraft having a smaller turn radius and slower climb speeds, it does not explain why (a) there is no equivalent flight path for Group 4 aircraft turning right after departure from runway 03 and (b) why aircraft of all Groups departing from runway 21 commence their turn only 350 metres from the departure end of the runway (as shown in Figure 16.2).

3.45 There are also serious questions about the length of the flight paths depicted in Figure 16.1. According to paragraph 16.3.13 of CD 1.41a, "(t)he length of the flight paths shown represents the extent to which each flight path affects the noise climate at ground level." However a comparison of Flight

Path 3 (used by all Groups of aircraft) and Flight Path 4 (used only by Groups 3 and 4) shows that FP3, which is used by the largest and noisiest jet aircraft types, extends only a short distance offshore, whereas FP4, which is only used by smaller aircraft, extends to a point which is at least twice as far from land. In addition, there is no explanation why FP5 is significantly longer than FP3, despite these flight paths being used by the same types of aircraft.

Flight path figures – runway 21 [Figure 16.2]

3.46 As with Figure 16.1, the boundary of R063 is shown approximately 350 metres too far north on Figure 16.2, and the boundary of D044 is shown too far south. This diagram therefore misrepresents the constraints in flight paths and in consequence cannot be a reliable basis for the noise contours.

3.47 There is no flight path shown for aircraft using the NDB approach to runway 21. This is an omission which has been consistent throughout all of LAA's submissions since 2006 but remains uncorrected. This flight path would take aircraft over New Romney.

3.48 FP9 and FP10 apparently show aircraft of all types flying a visual approach, joining from the east over the sea. However there is no equivalent flight path for visual approaches joining from the north or west. There is no reason why such an approach path should not be available. Any such visual approach paths from the north/west would pass over New Romney and would therefore increase aircraft noise in that area.

3.49 Paragraph 16.3.13 states "the length of the flight paths shown represents the extent to which each flight path affects the noise climate at ground level". However the depiction of Flight Paths 11 and 12 apparently shows Group 4 (light aircraft) types such as the Cessna 152 still affecting the noise climate on land when several kilometres offshore, well after take-off from runway 21, while Flight Path 11 stops a short distance after passing Lydd town, apparently indicating that Boeing 737s and Airbus A319s will cease to affect the noise climate only a mile after take-off. This is untenable.

RNAV approach procedures

3.50 In August 2009 Lydd Airport made available three new instrument approach procedures, based on satellite navigation. These are officially known as RNAV (GNSS) – Area Navigation (Global Navigation Satellite System) approaches. The three new procedures are:

- an RNAV (GNSS) approach to runway 21 for Category A and B aircraft
- an RNAV (GNSS) approach to runway 21 for Category C aircraft
- an RNAV (GNSS) approach to runway 03 for Category A, B and C aircraft.

3.51 The published charts for each of these procedures are reproduced as CDs 16.3 to 16.7.

3.52 The introduction of these procedures has several implications for the flight paths used as the basis for the noise model. First, the RNAV procedure for runway 03 allows aircraft to make approaches to land on that runway in poor weather conditions for the first time – albeit only when the Lydd Range is not active. This will increase the proportion of traffic which is able to land on runway 03 over and above the levels assumed in the noise model, since the latter assumed that all IFR traffic used the runway 21 approach to land.

3.53 Second, as noted above, since the RNAV approach to runway 03 is offset 5° from the extended runway centreline, the flight path differs from that depicted as FP15 in Figure 16.21. Any noise modelling based on FP15 will therefore be inaccurate.

3.54 Third, the approach flight paths for runway 21 depicted in Figure 16.2, and which form the basis for the noise contours generated by aircraft landing on runway 21, do not take account of the RNAV approaches to that runway. FP8 is the straight-in approach path. FP7 is the ILS approach path, which is offset 5° from the straight-in path. But the RNAV approaches to runway 21 are offset 14° from the runway centreline, significantly to the west of the ILS flight path. Thus the noise contours for runway 21 approaches will be inaccurate.

3.55 I conclude from the evidence presented in this section of my proof that:

- For the purposes of assessment of the impacts of the development, the baseline should be taken as the current and recent past levels of aviation activity at Lydd Airport, not the 300,000 passenger level which the airport has proposed.
- The noise contours which are the basis for the airport's assessment of the noise impact of the development are based on inaccurate and erroneous data on the types of aircraft which fly on particular flight paths. Consequently the noise contours should not be relied upon.
- There are inconsistencies in the depiction of which Flight Paths are used by which Groups of aircraft types. This raises further questions about the reliability of the noise contours.
- The fundamental assumption in the noise assessment that aircraft use runway 03 for 30% of the time and runway 21 for 70% of the time is unreliable because it overestimates the capability of larger and faster aircraft to land on runway 03.
- The airport's assumptions about the extent to which aircraft will be permitted to fly through the Lydd Range Danger Area are unreliable.
- The flight paths depicted in Figures 16.1 and 16.2 of the ES are unreliable because they omit the new RNAV approach orientations, and make a number of inconsistent and inaccurate assumptions about aircraft routings.

4. Feasibility of depicted flight paths

4.1 Notwithstanding the issues of the accuracy of the flight paths depicted in the ES, there are also questions over the feasibility of some of the flight paths proposed by LAA, in terms of the practical ability of aircraft of a given size to fly them.

Arrivals on runway 03

4.2 Figure 16.1 of CD 1.41a depicts the current and proposed flight paths for aircraft when runway 03 is in use (landing from the south, taking off towards the north). This figure also assumes that the Lydd Range is active and therefore that aircraft cannot fly through the range airspace, D044.

4.3 For arriving traffic, Figure 16.1 shows that only smaller aircraft (less than 5700 kg maximum take-off weight) would fly an approach from the east side of the airport. This is because there is insufficient room for larger (and therefore faster) aircraft to fly an appropriate radius of turn without infringing the 1.5nm radius circle of restricted airspace (R063) around the nuclear power stations. Consequently, all Group 2 and 3 aircraft are depicted as flying a curved approach from the west side of the airport (Flight Path1), over the town of Lydd, to join the final approach to runway 03.

4.4 Flight Path 1 is depicted as being used by all types of aircraft landing on runway 03, with the exception of Group 1 (aircraft of Boeing 737 and Airbus A319 size). This means that the airport's noise assessment assumes that aircraft up to and including the BAe146, a four-engined jet airliner of up to 44 tonnes weight with up to 112 passenger seats, will follow this flight path. Twin turboprop airliner types such as the Dash 8 and ATR42 are also expected to follow this flight path. All of these types are in Group 2 as defined by LAA.

4.5 It should be noted that LAA does not propose any qualifications on the use of Flight Path 1 by Group 2 aircraft, for example in terms of the weather conditions or flight rules under which it can be flown. It must therefore be assumed that LAA expects this flight path to be usable when the weather conditions require airliners to make an instrument approach to Lydd, as well as under conditions when a visual approach may be possible. However, the only way in which a Group 2 aircraft could fly an instrument approach into Lydd and subsequently land on runway 03 using Flight Path 1 would be by use of a procedure known as Visual Manoeuvring (Circling), often referred to in abbreviated form as a 'circling approach'. This technique is used when no instrument approach procedure is available for the runway in use (in this case, because the only instrument approach procedure for runway 03 is not available when the Lydd Range is active). Therefore, an instrument approach is flown to another runway (in this case, runway 21), then, when the crew gain sight of the runway, they manoeuvre the aircraft, by flying visually, to land on the runway in use.

4.6 The minima (minimum conditions of visibility and minimum altitudes to be flown) for instrument approach procedures vary according to the speed of the aircraft. For this purpose, international standards divide aircraft into five speed categories. Group 2 aircraft, as defined by LAA, would be in either Category B or Category C in terms of aircraft speed. On the instrument approach procedure chart for the ILS approach to runway 21 [CD 16.4], in the top right hand corner it can be seen that the procedure is designed for Category A, B and C aircraft types. In the bottom left hand corner is a table headed 'Aircraft Category'. This sets out the Obstacle Clearance Altitude (OCA – in basic terms, the minimum altitude to which the aircraft can descend) for each aircraft category. The first row gives the OCA for aircraft flying the straight-in ILS approach to land on runway 21. The second and third rows give the "VM(C)OCA" – the Obstacle Clearance Altitudes for aircraft using the runway 21 ILS to fly a circling approach to land on runway 03.

4.7 It can be seen that an OCA value for circling in the 'Total Area' is only given for Category A aircraft. This means that only Category A aircraft (broadly similar to LAA's 'Group 4' types) are permitted to fly a circling approach either to the west of the airport or to the east of the airport. In the third row, OCA values are given for Category B and C aircraft circling to the west of runway 03/21. This means that Category B and C aircraft are only permitted to fly the circling manoeuvre to the west of the airport. This is believed to be because the proximity of Dungeness power station precludes circling to the east of the runway by these categories of aircraft.

4.8 The feasibility of Flight Path 1 therefore depends on the ability of Category B and C aircraft to fly a circling approach with an adequate margin to ensure that they do not infringe the D044 danger area.

4.9 Circling approaches are generally regarded by pilots – particularly those flying large commercial passenger aircraft – as one of the most exacting flight procedures. The procedure requires the pilots to manoeuvre the aircraft at low altitude, often just below a low cloudbase and in poor visibility, maintaining sight of the runway at all times, and maintaining separation from obstacles visually. Because of the need to stay within a specified radius from the runway in order to avoid obstacles and keep the runway in sight, very close attention has to be paid to the aircraft's speed and positioning relative to the runway. Aircraft manufacturers specify the recommended parameters for flying a circling approach in the aircraft's operating manual. In addition, each airline has its own procedures for carrying out a circling approach set out in its CAA-approved Operations Manual. Typically, these will specify the distance from the runway at which the 'downwind' leg (parallel to the runway) is flown, and the timing to be used from abeam the runway threshold until commencing the turn on to base leg.

4.10 To illustrate, Appendix 7 shows the manufacturer's recommended method for flying a Visual Manoeuvring (Circling) procedure in the Saab 340, the smallest and one of the slowest of the airliners listed by LAA in their 'Group 2' category – those which are stated to be capable of landing on runway 03 using Flight Path 1.

4.11 It can be seen from this procedure that the aircraft flies downwind, parallel to the runway and positioned approximately 2km laterally from the runway. At this stage of the approach the aircraft will have flaps set to 15° and will be flying within the maximum speed for this category of aircraft of 135 knots.[2] When the aircraft reaches a point abeam the threshold of the runway, the crew start timing in order to determine the point at which the turn towards the runway must be initiated. The basis for this is 30 seconds of flight time minus one second for every knot of tailwind. In the case of runway 03 at Lydd it is assumed that the wind is from 030° at 15 knots (allowing for aircraft to land in a tailwind on runway 21 when the wind speed is lower than this). Thus the timing to the start of the turn in this case would be 15 seconds.

4.12 In constructing the ground track of a Saab 340 flying a Visual Manoeuvring (Circling) approach to runway 03 at Lydd the following additional assumptions have been made:

- ground speed on the downwind leg is 150 knots (135 knots airspeed plus tailwind of 15 knots)
- a bank angle of 30° is used for all turns
- no allowance is made for the time taken for the aircraft to roll from wings level to 30° angle of bank and vice versa[3]
- turns are flown at a ground speed of 125 knots (giving a turn radius of 732 metres)
- the ground track of the aircraft in the turn takes no account of the effects of the wind.

4.13 The resulting ground track is shown in Appendix 8. It shows that the aircraft would just infringe the northern boundary of the Lydd Range Danger Area. When account is taken of (a) the time taken for the aircraft to roll to 30° bank, (b) the effect of the tailwind causing the aircraft to drift further south during the turn and (c) the aircraft's speed in the turn being in excess of 125

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2 ICAO Doc 8168, Vol.2, Part I, Section 4, Chapter I, Table I-4-1-2.

3 To illustrate, a roll rate of 5° per second would mean that the aircraft had travelled some 460 metres further downwind, towards the D044 range boundary, from the initiation of the roll to the left until the point where 30° bank is achieved.

knots in practice, it is clear that the extent of infringement of the Danger Area would be greater in practice than that shown in the diagram. In addition it should be noted that the Saab 340 is the one of the slowest aircraft types in Group 2. Other types in Group 2 such as the BAe146, Gulfstream IV and ERJ135 have faster approach speeds and therefore wider turn radii, and would not be able to turn as tightly as the Saab 340 ground track illustrated in Appendix 8. They would therefore infringe the range danger area to a greater degree than that illustrated.

4.14 Flight Path 1 in Figure 16.1 of CD 1.41a shows aircraft initially making a wide radius turn from the downwind position, over the town of Lydd, then, once past the town, the flight path is depicted entering a much sharper (smaller radius) turn on to the final approach. The turn radius is difficult to measure from the map since it appears not to be constant, but this flight path is likely to require a turn radius of less than 600 metres. At the minimum 125 knot speed assumed above for the Saab 340, this would require bank angles in excess of 35°. This would not be acceptable for commercial air transport operations, particularly in this case where the crew may be flying the aircraft at low level in marginal visibility and low cloudbase and would have to be simultaneously ensuring (visually) that they were clear of the Danger Area and also clear of the many vertical obstacles in the vicinity, notably the double power line with pylons up to 207ft in height in the northern parts of Lydd Camp.[4]

4.15 It can be concluded that Flight Path 1 is not a viable approach path to runway 03 for most if not all aircraft types designated as Group 2 by the airport. This would certainly apply in the case of Visual Manoeuvring (Circling) approaches, and is also highly likely to apply to visual approaches.[5]

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4 The minimum obstacle clearance for a Category B aircraft such as a Saab 340 on a Visual Manoeuvring (Circling) approach is 295ft. The aircraft would pass close to or over pylons 207ft in height. The pilots would therefore have to confirm visually that they had passed the pylon lines before they could commence descent from their minimum circling altitude of 510ft.

5 A visual approach is one in which the aircraft does not follow an instrument approach procedure but flies by visual reference to the ground. Pilots of IFR flights can request a visual approach when they are in sight of the ground and are able to continue to fly the approach remaining in sight of the ground. The downwind leg of a commercial

Consequently these aircraft could not land on runway 03 when Danger Area D044 is active. They would have to land on runway 21 with a tailwind, or, if the tailwind exceeds the operational limits of the aircraft, they would have to divert to another airport (or cancel the flight before departure).

4.16 The viability of Flight Path 1 in the presence of Danger Area D044 can be compared to Farnborough Airport, which has the Ash military firing range (Danger Area D132) in the vicinity. A map showing the location of the danger area relative to Farnborough Airport is provided at Appendix 9. The shortest distance between the threshold of runway 24 at Farnborough and the boundary of D132 is 3.62 km. This compares to 2.25 km between the threshold of runway 03 at Lydd and the boundary of D044. D132 is not promulgated as permanently active but is only active when notified. It extends from ground level to 2500 feet.

4.17 Farnborough Airport has published Instrument Landing System and Surveillance Radar instrument approach procedures to both runway directions. However, in relation to Visual Manoeuvring (Circling) approaches, all of the instrument approach procedure charts contain the warning "CAT B,C and D no circling when D132 is active".[see Appendix 10] This means that circling approaches by all aircraft of Beech 200 size (twin turboprop, less than 5700 kg) and upwards are prohibited when D132 is active. Category A aircraft (almost entirely light single-engined aircraft) can continue using circling approaches when D132 is active because the obstacle assessment area for this category of aircraft extends to only 3.12 km from the runway threshold, and therefore does not encompass the D132 danger area.

4.18 A further example of circling procedures being restricted because of the proximity of a military danger area is at Southend Airport. The nearest boundary of Danger Area D138 – the Foulness ranges – lies 7.9km south east

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aircraft visual approach is typically flown at 1500ft, compared to 510 or 790ft for the circling approach to runway 03 at Lydd. Thus the aircraft must fly a longer distance downwind before turning in for the final approach, in order to allow room to descend to the required height. This would mean penetrating further into the D044 danger area.

of the threshold of runway 24. This is just beyond the obstacle assessment area for Cat.C aircraft of 7.85 km but is within the Cat.D obstacle assessment area of 9.79 km. Consequently the Southend ILS chart for runway 24 [see Appendix 11] is annotated "CAT D circling not authorised south of runway 06/24 centreline".

4.19 If the criteria which have been applied to the usability of circling procedures at Farnborough and Southend were applied at Lydd, all circling procedures there would be banned,[6] or, at the very least, each of the instrument approach procedure charts would contain the warning "circling procedures only available when D044 is inactive".

4.20 There is one further aspect of the depiction of runway 03 arrival/departure flight paths in Figure 16.1 of the ES which is questionable. As depicted on that diagram, VFR traffic (principally Group 4 aircraft types) arriving from the north or west would approach using Flight Path 1, over the town of Lydd. However this is not in accordance with the standard circuit joining procedure for VFR traffic at Lydd, as published in the UK AIP at EGMD AD 2.22 paragraph 2.d [CD 16.1] and in the circuit joining diagram on the Lydd Aero Club website [see Appendix 12]. In the latter two sources, VFR traffic is instructed to fly across the airfield at 1500 feet, then make a descending right turn on to the downwind leg for runway 03, east of the airport. These aircraft are specifically instructed not to follow Flight Path 1.

Departures on runway 21

4.21 Figure 16.2 depicts the proposed flight paths for aircraft approaching and departing from runway 21. The diagram specifies that a right turn on departure from runway 21 will be used by all Groups of aircraft, including Group 1, while a left turn on departure from runway 21 will only be used by

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6 Circling procedures to the east of the airport are already banned for Cat.B and C aircraft, it is believed because of the proximity of the nuclear power station restricted airspace. However the Cat.A obstacle assessment area of 3.12 km radius also overlaps both D044 and R063, therefore any ban as outlined would apply to Cat.A aircraft types too.

Group 4 types. This is because left turns by aircraft in Groups 1, 2 and 3 are precluded by the nuclear power station restricted airspace, R063.

4.22 The regulatory limitations on take-offs by commercial aircraft are designed to ensure that aircraft operate at a weight which allows them to take off safely in the available runway distance and clear all obstacles under the flight path by a specified safe distance. The more fuel and passengers being carried by the aircraft, the heavier it is. Heavier aircraft will require a longer runway length for take-off and will also have a lower rate of climb. In commercial aircraft operations, operators will in general seek to maximise the payload (passengers and/or freight) which the aircraft can carry given the constraints of the runway and any obstacles under the climb-out path. Where these constraints prevent operations at the certified maximum weight of the aircraft, the crew must ensure that the weight of the aircraft is reduced so that it can operate within the constraints.

4.23 The calculation of the appropriate weight of the aircraft, which must be done by the flight crew before every take-off, is based on an assumption that one engine fails at a critical point during the take-off run. The calculations used to determine these factors are highly complex, depending on variations in many criteria including air temperature, air pressure, wind direction and speed, the configuration of the aircraft, the height of the airfield above sea level, whether the runway is wet or dry and the location and height of obstacles. In modern commercial airliners these take-off performance calculations are predominantly carried out by onboard flight management computers. However the principles are set out in the European Aviation Safety Agency (EASA) Certification Specifications for Large Aircraft (CS-25), and in the European Union rules for operation of commercial aircraft, EU-OPS 1. The section of this document relating to take-off obstacle clearance, EU-OPS 1.495, is reproduced at Appendix 13.

4.24 In the case of large commercial aircraft departures from runway 21 at Lydd, there are three over-riding considerations:

- the available length of runway

- the requirement to turn right as soon as possible after take-off in order to remain clear of the Lydd Range danger area
- the requirement to clear all obstacles, including the 200ft electricity pylons at the edge of the danger area, by the required vertical or horizontal margin in the event of an engine failure.

4.25 These three factors have complex interactions. For example

- an aircraft which takes off at the maximum weight which will allow it to get safely airborne in the available runway distance, may not have sufficient room to complete the right turn without infringing the Danger Area, because higher weights require a longer take-off run and higher speeds, leading to a wider radius of turn; and because the reduced rate of climb will mean the aircraft has to fly straight ahead for a greater distance before reaching the minimum altitude at which a turn can be initiated
- the rate of turn required to clear obstacles by an adequate margin horizontally may require a speed which is below the minimum required for the safe flight of the aircraft (the lower the speed, the smaller the radius of turn; however stalling speed increases in a turn so minimum flying speed must increase during turns[7]).

4.26 Of the three factors listed above, the requirement to turn tightly enough to adequately avoid the range danger area is likely to be the most limiting. There are no regulatory provisions which set out the minimum distance by which danger area airspace – as opposed to physical obstacles - must be avoided. However, as shown in paragraphs 4.16 to 4.18 above, there are examples of the CAA designing instrument approach procedures on the basis that a danger area extending from, say, ground level to 2500 feet is treated as if it was a 2500ft high obstacle. If that principle was applied to departures of commercial aircraft from runway 21, aircraft would have to avoid the edge of

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7 For reference, the European regulatory authorities advise that at an angle of bank of 20°, the minimum speed should increase by 5 knots, and at an angle of bank of 25°, the minimum speed should increase by 10 knots – JAR-OPS 1, AMC-OPS 1.495(c)4.

the D044 danger area by a horizontal distance derived from the formula in EU-OPS 1.495(a) [see Appendix 13].

4.27 Assuming a turn started at the end of the current declared Take-Off Distance Available (TODA)[8], a turn radius of no greater than 1280 metres would have to be achieved to ensure that the aircraft met the EU-OPS 1.495 required horizontal clearance from the danger area. The flight path of this turning departure from runway 21 is shown on the diagram in Appendix 14. For an aircraft such as the Boeing 737-700, with a typical V2 speed[9] of 140 knots, achieving a 1280m radius turn would require the average angle of bank during the turn to be 23°. However, as noted above, the European civil aviation regulatory authorities advise flying at V2+5 knots when the angle of bank is 20° and V2+10 knots at 25° angle of bank. But those required speed increases would themselves require a further increase in the angle of bank in order to achieve a 1280m radius turn – to 24° at 145 knots and 26° at 150 knots.

4.28 These figures are *average achieved* angles of bank, but they make no allowance for the time taken to roll from wings level to the required bank angle at the start of the turn. They also take no account of the limits placed on bank angle during departure turns by EU-OPS 1.495 [see Appendix 13]. This requires that, in normal circumstances, turns by a Boeing 737 or Airbus A319 size aircraft cannot be commenced until the aircraft is 56 feet above the elevation of the end of the runway; that bank angle is then limited to 15° up to 400 feet, and to 25° above 400ft. However, an operator can obtain special approval from the CAA to use greater bank angles. These will be:

- not more than 15° below 200ft
- not more than 20° between 200 ft and 400 ft
- not more than 30° above 400 ft.

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8 TODA is the length of the runway plus the length of any Clearway beyond the end of the runway. In the case of Lydd runway 21, the end of the TODA is 176 metres beyond the end of the runway, immediately north of the Dungeness-Lydd railway line.

9 V2 is the take-off safety speed – the minimum speed, assuming one engine has failed, which ensures obstacle clearance in the initial stages of the climb-out.

4.29 Even using the maximum limits of those specially approved increased bank angles, it is highly unlikely that any Boeing 737 or Airbus A319 size of aircraft could achieve an average angle of bank of 24° or 26° in the turn to avoid D044. Smaller airliners would also be severely constrained by this turn manoeuvre.

4.30 There are also certain additional requirements imposed by Appendix 1 to EU-OPS 1.495 when seeking approval for use of the increased bank angles set out above [see Appendix 13]:

- the aircraft's flight manual must contain approved data for the increased bank angles and speeds required
- visual guidance must be available for navigational accuracy
- weather and wind limits must be specified and approved by the CAA
- the flight crew must receive specific training.

4.31 The requirement for "visual guidance" is detailed in section 2 of AMC[10] OPS 1.495(d)(1) and (e)(1) [see Appendix 13]. This stipulates that for obstacles to be considered visible from the flight deck they must be located more than 45° either side of the intended flight path, and must be no lower than 20° below the horizontal as viewed from the flight deck. In the case of departures from runway 21 at Lydd turning right as soon as possible and seeking to maintain a bank angle of at least 24°, the key requirement will be to ensure, visually, that the aircraft keeps to the right of identifiable features which mark the range boundary. This will require the captain (who occupies the left hand seat) to identify those features out of the left hand window, and keep them in sight throughout the turn. But to achieve that from the left hand seat of an aircraft in a 24° or more banked turn to the right would be extremely difficult, and perhaps impossible.

4.32 The AMC also specifies that, to use the specially-approved increased bank angles, minimum cloud ceiling and visibility must be established to

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10 Acceptable Means of Compliance

ensure that the specified ground reference points remain in sight throughout the departure.

4.33 There are no comparable turning departures at any airport in the UK. I have also researched departure procedures at airports around the world to find any with similar features to those that would be required for runway 21 at Lydd. The closest comparisons found were the Runway 30 Pitt Water (Visual) Standard Instrument Departure (SID) from Hobart Airport in Tasmania, Australia, and the Runway 15 SID from Cairns Airport in Queensland, Australia. The published procedure charts for those departures are at Appendices 15 and 16.

4.34 It can be seen that the Hobart procedure does not specify any maximum speed or minimum bank angle requirements but can only be flown when the cloud ceiling is at or above 1000ft and the visibility is at least 5000 metres. This is to allow the crew to keep the high ground north of the airport in sight in order to clear it safely. The Hobart procedure is flown by some airlines but other operators do not permit their crews to fly this departure. Runway 30 at Hobart Airport has a Take-Off Distance Available of 2461 metres.

4.35 The Cairns procedure does not have any cloud ceiling or visibility minima – it can be flown in cloud or poor visibility – but it must be flown at a speed no greater than 190 knots and with a bank angle no less than 25°. This procedure is regularly flown by large jet operators. Runway 15 at Cairns Airport has a Take-Off Distance Available of 3256 metres.

4.36 In order to provide a clear comparison between the Hobart and Cairns departures and the required right turn departure off runway 21 at Lydd, the boundary of the Lydd range danger area has been superimposed (in purple) in the appropriate position, relative to both runways, on Google Earth images of Hobart and Cairns Airports, annotated in red with the 'swathes' of the departure paths. These are shown at Appendices 17 and 18. It can be seen that, if the Cairns or Hobart procedures were put in place at Lydd, aircraft flying those departures could not be assured of keeping clear of the range. In other words, any departure procedure for runway 21 at Lydd would have to have even more demanding speed, bank angle and/or weather minima criteria than those in place at Cairns and Hobart.

4.37 Clearly, the Cairns and Hobart procedures are designed to Australian, rather than the European standards which apply at Lydd. One of the closest parallels in Europe is Nice Airport in France, where the departures from the two parallel runways 04L and 04R require an early right turn to avoid high terrain straight ahead. The Nice runway 04 departure procedure chart, superimposed with the boundary of D044, is shown at Appendix 19. It can be seen that the existing departure procedure at Nice, if it was established for runway 21 at Lydd, would infringe the Lydd danger area. Runway 04R at Nice Airport has a Take-Off Distance Available of 3500 metres. Runway 04L has a Take-Off Distance Available of 2570 metres.

4.38 In summary, it is clear that Group 1 aircraft, and most if not all Group 2 aircraft, would have severe difficulty flying a turning departure off runway 21 while the Lydd range is active. Airlines would be likely to have one of two responses to this:

- limit the aircraft weight in order to allow the aircraft to get airborne in a shorter distance and therefore have sufficient room to complete the turn, or
- depart from runway 03 unless this was prevented by the strength of the tailwind.

4.39 Since the restrictions on departures from runway 21 would lead to more departures from runway 03, this will be another reason why the assumed 70/30 modal split is unreliable as a basis for the noise and other assessments.

4.40 I conclude from the evidence presented in this section of my proof that:

- Flight Path 1, which is the only means by which airliner-sized aircraft can make an approach to runway 03 when D044 is active, is not a viable flight path for most or all of these aircraft because the distance between the runway threshold and the boundary of the D044 range is insufficient to accommodate the required manoeuvre safely.
- Consequently, it can be concluded that airliners will be unable to operate into Lydd Airport when the wind speed and direction requires them to land on runway 03 and the Lydd Range is active.
- For commercial airliners departing from runway 21 when the Lydd Range is active, the radius of turn required to avoid the range by an adequate safety margin would in turn require a bank angle which is unlikely to be achievable under European air safety rules.
- There are no departure turns at any other UK airport which are equivalent to what would be required from runway 21 at Lydd. Examples from Hobart, Cairns and Nice show that the Lydd runway 21 departure turn would be more challenging than those.
- Airlines will have to place stricter limits on the weight of departing aircraft in order to complete the turn on departure from runway 21, or will choose to depart from runway 03 when the wind permits.

5. Noise and visual impacts

5.1 This section of my evidence reviews information in the London Ashford Airport (LAA) response to questions from Shepway District Council, dated December 2009 [CD 1.44], relating to the noise and visual impacts of arriving and departing aircraft and drawing comparisons between an ATR 42-300 and a Boeing 737.

5.2 Paragraphs 6.9 to 6.15 of the Main Report seek to address the issue of whether birds in the SPA would become habituated to the noise and visual impact of aircraft using LAA.

5.3 Paragraph 6.10 notes that it is not possible to differentiate noise impacts from visual impacts. However in subsequent paragraphs the airport seeks to draw parallels between current and future aircraft activity, concluding that there would be no significant change in visual disturbance as a result of the proposed development of the airport.

5.4 At paragraph 6.11 of the Executive Summary document, LAA states

> The photomontage below show a ATR 42-300 aircraft at the same position as a Boeing 737 aircraft, which was photographed during landing at the airport in February 2007 during a noise trial. The photograph was not taken at Lade Pit, but at Greatstone Primary School, which is approximately the same distance from the airfield as the SPA.

5.5 Subsequent paragraphs claim that the ATR42 and the Boeing 737 are similar in size and speed and that there would be "very little difference in the visual disturbance to bird populations" with movements of a Boeing 737 compared to an ATR42.

5.6 In terms of the validity of using the ATR42 as an example of the current activity at the airport, this is a longstanding issue since the submission of the original Environmental Statement in 2006. LAA has sought to portray baseline activity at the airport as including 320 commercial movements a year by twin-turboprop airliners (of which 120 are by ATR42s) in the 'Existing Operations' scenario, and 5810 (of which 2190 were by ATR42s) in the 'Future Baseline' scenario (300,000 passengers a year with no runway extension).[CD 1.24c, Appendix 4]

5.7 The ATR42 is a rare visitor to Lydd Airport. There was only one visit to Lydd by an ATR42 in 2005.[Appendix 16.4] A single ATR 42-312F (a cargo version of the ATR 42-300) was operated from Lydd in late 2009/early 2010, but this aircraft's operations at Lydd were confined to non-revenue empty positioning flights.

5.8 In terms of the LAA statement that visual disturbance by a Boeing 737 is likely to be similar to that caused by an ATR42 "comparing the two aircraft from the perspective of a bird", there is nothing in the LAA document to substantiate that claim. The quoted dimensions of the 737 are 38 to 57% larger than those of the ATR42, while the 737's wing area – a dimension not quoted by LAA but which is likely to be highly relevant to the visual appearance of the two aircraft types from below – is 129% larger than that of the ATR42.

5.9 The location of the photographs (Main Report p.18) to illustrate the visual disturbance is questionable. While reference is made to Greatstone Primary School (the location of the photos) being a similar distance from the aircraft as the SPA site at Lade Pit, the worst case location within the SPA for visual disturbance is likely to be the section north of Boulderwall Farm. This is significantly closer to the runway 21 climb-out/runway 03 approach than Lade Pit. It may also be worth noting that, while the photos depict aircraft on final approach to runway 21, aircraft taking off are likely to generate greater visual impact because they will appear more suddenly, they will be accelerating, and the combined noise and visual impact will be greater due to high power settings.

5.10 While CD 1.44 states that is not possible to de-couple noise from visual impact, the implication that the combined noise and visual impact of an ATR42 is somehow comparable to that of a Boeing 737 is not sustainable when the respective noise profiles of the two aircraft types are compared. Appendix 20 is an excerpt from a document published by Seattle-Tacoma Airport in the USA. It provides a graphic illustration of the difference in noise footprint between a Boeing 737-700 (centre-right of the diagram) and a Dash 8-400 (far right). The Dash 8-400 is similar to the ATR42 in that it is a twin-turboprop airliner. However it is significantly larger than the ATR42 and its US Federal Aviation Agency certified noise levels are higher in all phases of flight than those of the ATR42. It can be seen from this that the noise footprint of a twin-turboprop aircraft such as the ATR42 is a fraction of the size of that of a Boeing 737 and that, concomitantly, the level of noise generated by a Boeing 737 is significantly greater at a given distance from the flight path than that of the ATR42.

5.11 I conclude from the evidence presented in this section of my proof that:

- The use of the ATR42 as the baseline aircraft from the point of view of assessing the noise and visual disturbance of birds is invalid since it is an infrequent user of the airport.
- The claim that the ATR42 and Boeing 737 are likely to generate similar visual disturbance is untenable since all variants of the Boeing 737 are significantly larger than the ATR42.
- The location of the photographs taken to illustrate visual disturbance is likely to understate the visual impact, particularly of aircraft departing from runway 21.
- The implication that the noise impact of an ATR42 and a Boeing 737 are comparable is untenable. The noise footprint of a Boeing 737 is several times larger than that of an ATR42.

6. Flight path assumptions in assessments made by the Nuclear Installations Inspectorate

6.1 This section of my evidence addresses a number of questions relating to assessment by the Nuclear Installations Inspectorate of the Lydd Airport expansion plans, namely:

- changes in the operating environment at Lydd Airport since the conclusion of the previous Nuclear Installations Inspectorate (NII) report on Lydd Airport's runway extension proposal in 1988;
- review of the flight path assumptions in the 1988 NII report, and how they compare to the NII's flight path assumptions in relation to the current Lydd Airport development proposal;
- assessment of likely crash scenarios.

Changes in Lydd Airport operating environment since 1988

6.2 The NII carried out an assessment of the nuclear safety implications of LAA's previous proposal for a runway extension in 1988. The 1988 NII report is CD 13.5.

6.3 Since the NII report was written in 1988 the following changes have taken place in the aviation environment and facilities at Lydd Airport:

- The upper limits of the Lydd and Hythe Ranges were raised on 14 June 2001, from 3200 to 4000 feet at Lydd and from 2000 to 3200 feet at Hythe. The main impact of these changes was on the viability of an ILS procedure for runway 21.
- The published hours of operation of both the Lydd and Hythe Ranges have been increased from "0800-2359 Local and When Notified", to 24 hours a day.
- Imposition from 5 September 2002 of a statutory requirement to remain at least 1.5nm clear horizontally (or 2000ft vertically) of the Dungeness power station under the terms of Statutory Instrument 2002/2254. This

made left turns on departure from runway 21 by larger aircraft impossible.

- Replacement of the ILS (which, in 1988, had been a conventional installation with its localiser aerial located south of the end of runway 21) with a 5° offset ILS, with the localiser aerial located south of the runway, on the disused runway 14/32. The glideslope angle is unchanged since 1988, at 3.5°, but the 1988 installation did not have a localiser beam offset from the runway centreline.
- The straight-in NDB instrument approach procedure to runway 21, along the extended centreline of the runway, has been replaced by an NDB approach procedure which is offset by 21° from the runway orientation. The manoeuvre to land on runway 21 from this approach requires aircraft to point towards the power station.
- Approval of Visual Manoeuvring (Circling) instrument approaches which permit Category A aircraft to fly circling manoeuvres to the east of the airfield, towards the nuclear power stations, and permit Category B and C aircraft to fly these manoeuvres to the west of the airfield.
- Removal of the air traffic control radar. This had an important role in 1988 in assisting pilots to remain clear of restricted airspace as well as performing its principal role of ensuring separation between aircraft. There is no reference in the current plans for the airport to the installation of a radar. Indeed the airport has specifically ruled out installing radar until it is handling in excess of 500,000 passengers a year.[11]
- Approval of RNAV (GNSS) (satellite navigation) instrument approaches in August 2009.

6.4 With the exception of the new RNAV approaches, all of those changes either increase the constraints on Lydd Airport operations and/or reduce the

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11 "Given the number of flight movements per annum in both the 300,000ppa and 500,000pa scenarios, it is not considered necessary to install radar service. A radar service will only be considered after the airport reaches a certain level of movements per annum." [CD 1.21, para 3.28]

margins of safety in respect of the risk of an aircraft crashing on the Dungeness nuclear power station.

6.5 The assessment in the 1988 NII report was based on a plan of flight paths submitted by the airport which bear close similarities to the flight path assumptions forming the basis for the current proposals. The flight paths plan used by the NII in 1988 is at Appendix B of CD 13.5. The flight path assumptions for the current proposals are at CD 1.41a, Figures 16.1 and 16.2.

6.6 NII's initial assessment focused on whether any of the proposed flight paths were unacceptable from the point of view of nuclear safety. The results of this initial assessment were that flight path D8 – a sharp left turn on departure from runway 21, to pass north of the power station – was "unacceptable because aircraft taking off would be pointing directly at the power stations for some part of the flight path". Consequently "Lydd Airport Group agreed to withdraw these flight paths".[CD 13.5, para 5] As a result of this, the airport entered into a Section 106 agreement which imposed on them a legal commitment that "with the exception of visual circuits no aircraft having a maximum take off mass (hereinafter called "M.T.M.") of 5.7 tonnes or less shall turn left on departure from runway 22".[12] [see Appendix 21]

6.7 Under the current proposals, Lydd Airport is once again proposing such a flight path for aircraft under 5700kg (FP12 in Figure 16.2 of CD 1.41a), yet NII now apparently regards this flight path as being acceptable from the point of view of the risk of an aircraft crash on the Dungeness nuclear power stations. I am not aware of any explanation of why the NII should regard FP12 as unacceptable in 1988 but now apparently regards it as acceptable.

6.8 In 1988, NII agreed that arrivals on runway 03 (04 as it was then) were permissible using a flight path from the west/north west, over the town of Lydd – flight path A5 in Appendices A and B of CD 13.5. This flight path would

12 NB the runway designated as runway 22 in 1988 is now known as runway 21 due to changes in magnetic variation since 1988.

have involved aircraft pointing at the power stations as they turned towards the airport, west of the town of Lydd. But Appendix A of the 1988 assessment makes clear that flight path A5 could only be flown by aircraft less than 5.7 tonnes. By contrast, under the current plans, the airport proposes that Flight Path 1 (in Figure 16.1 of CD 1.41a) is flown by all aircraft other than those in Group 1. This means that aircraft up to 40 tonnes in weight (BAe146) would be expected to fly this approach path. Moreover, as depicted in Figure 16.1, Flight Path 1 points at the power station in the area south east of the town of Lydd, closer to the power station than flight path A5 in 1988, and immediately before having to make a sharp left turn to line up with the final approach to runway 03. Flight Path 1 in the current proposals is therefore more critical from the point of view of risk of an aircraft flying towards the power stations than was flight path A5 in 1988. I am not aware of any explanation of why this flight path was deemed by the NII in 1988 to be unacceptable, other than for aircraft of less than 5.7 tonnes, but is now deemed to be acceptable for aircraft up to the size of regional airliners such as the BAe146.

6.9 The 1988 NII report based its assessment on traffic figures and a fleet mix which were subsequently agreed as planning conditions, one of which was that no more than 6,000 movements per annum would be permitted by jet or turbofan aircraft or propeller-driven aircraft greater than 5.7 tonnes MTWA.[CD 13.5, Appendix C, paragraph 1]

6.10 The current Lydd Airport proposals involve, at the maximum proposed level of 500,000 passengers with the new terminal and runway extension, 15,695 movements by aircraft types in the above categories. These are as follows:[CD 1.34a]

- jet/turbofan aircraft: B737, A319, BAe146, Learjet 35A, Citation II, CNA750 Citation X – total 35 movements per day = 12,775 movements per annum
- propeller-driven aircraft >5.7 tonnes: Dash 8, ATR42-500, Saab 340/SF340B - total 8 movements per day = 2,920 movements per annum.

6.11 These traffic levels are in excess of two and a half times the number of aircraft movements on which the 1988 assessment was based. NII stated in its 1988 report that it "would wish to reassess the situation if an increase in numbers were to be proposed".[CD 13.5, paragraph 19] Clearly, NII has carried out a re-assessment in relation to the current proposals. However it is difficult to see how the NII has reached its current conclusion that there is no reason to object to the proposals on safety grounds given that:

- before even beginning any quantitative analysis, in 1988 the NII determined that any scenario involving any left turn departures off runway 21, other than aircraft in the visual circuit, was unacceptable from a nuclear safety viewpoint. In 2008 NII appears to be saying that all such departures are acceptable.
- in 2008 NII stated that "the risk of impact on the nuclear site primarily comes from random failures of aircraft, unconnected with take off and landing activities at Lydd Airport".[see Appendix 22] By contrast their 1988 report was based solely on the risk posed by operations at Lydd Airport, with no mention of any other aviation activity, and reached its conclusions that the planned expansion is acceptable only after getting the airport's agreement never to allow any aircraft (other than those in the visual circuit) to turn left on departure from runway 21.

Assessment of likely crash scenarios

6.12 In 1988 the NII was clearly concerned that a failure in an aircraft at a time when it was pointing towards Dungeness power station could lead to the aircraft flying over the power station and possibly crashing into it. As a result they were not prepared to accept any flight paths which were likely to have that outcome.

6.13 Under the current LAA proposals there are four scenarios which might give rise to similar concerns:

- engine or other failure during a left turn departure off runway 21, necessitating the aircraft rolling out of the turn and pointing directly at the power station
- engine or other failure to an aircraft flying an ILS, NDB or RNAV approach to runway 21 which precludes the aircraft from making the required right turn on the missed approach
- engine or other failure to a Category A aircraft flying a Visual Manoeuvring (Circling) approach to the east of the airport to land on runway 03, while it is flying the downwind leg, towards the power stations
- engine or other failure to a Category A, B or C aircraft flying a Visual Manoeuvring (Circling) approach to the west of the airport to land on runway 03, while it is flying the base leg, towards the power stations.

6.14 The first of these scenarios was clearly regarded by NII in 1988 as sufficiently probable for it to be unacceptable at any level of movements. This led to NII obtaining LAA agreement that flight paths D8 and A8 would be withdrawn.

6.15 In the second scenario, an aircraft flying straight ahead on the ILS final approach track of 209° Magnetic, having suffered a failure that prevented it from turning right, would miss the power station by 1.6nm. This horizontal separation is likely to be regarded as acceptable. However the safety of that flight path depends on the emergency procedures for stopping firing on the Lydd Range working quickly enough. An airliner would take approximately a minute and a half to fly from the missed approach point to the boundary of the range danger area. If the Lydd air traffic controller was unable to get confirmation of a cessation of firing well inside that time, he might have no choice but to advise the crew of the aircraft to turn left to avoid the range, thereby directing them towards, or close to the power station.

6.16 The circumstances in which the second scenario might occur have changed since 1988. Go-arounds from the ILS approach are now more likely because it is offset from the runway centreline by the maximum allowed 5°, as well as having the steepest allowable glidepath. In addition to that, Lydd Airport has based its operational case on airliners using runway 21 for landing in tailwinds of up to 10 knots – a much larger tailwind component than is accepted at other UK airports with preferential runway schemes.[13] Putting those factors together – high ground speed due to a tailwind, a steeper than normal approach and the requirement for a turn to align with the runway at a late stage in the approach – makes it much more likely that the aircraft is not stabilised on the approach in time to make a safe landing, and the crew opt to go-around.

6.17 Similar issues arising in relation to the NDB approach are less probable, because the Lydd NDB procedure is an extremely cumbersome and difficult procedure to fly, and would only be considered by commercial aircraft pilots if both the ILS and RNAV procedures were unavailable. However the potential consequences of a failure to an aircraft flying the NDB approach are greater than those for go-arounds off the ILS approach, because (a) in a go-around straight ahead from the NDB final approach, the aircraft would pass 1.1nm from the power station, which may be regarded as too small a margin for error, and (b) the NDB procedure requires the aircraft, when becoming visual with the runway, to make a left turn followed by a right turn (known as a 'sidestep manoeuvre') in order to line up with the runway centreline for landing. If a failure occurs during those turns, the aircraft could be forced to make a go-around straight towards the power station.

6.18 Failures occurring at a late stage in the RNAV approach to runway 21 are also likely to have greater potential consequences for the risk of a crash on the power station than in the case of the ILS approach because, whereas the ILS approach is offset 5° from the runway centreline, the RNAV approaches to runway 21 are offset 14° from the runway centreline. Thus aircraft flying this approach are pointed closer to the power stations.

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13 At Heathrow, Birmingham and East Midlands, the preferred runway is only used when the tailwind is 5 knots or less.

6.19 The likely consequences of both the second and third scenarios are worse in 2008 than in 1988 because of changes in the operations at Lydd Range. In 1988 the NII was told by the airport that flight paths through the Lydd Range might be available 50% of the time.[CD 13.5, paragraph 10] In the current proposals, LAA has stated that flight through the Lydd Range might be available 37% of the time, although as explored above (paragraph 3.28), it is not clear how reliable that figure is. The available evidence suggests that the only reliable times when the Lydd Range is closed are between 2300 and 0830. The airport has made a commitment to ban all flights between 2300 and 0700. Thus the only period when the range is normally closed and the airport will be open is 0700-0830. Consequently, whereas in 1988 in half the cases of failures resulting in a straight-ahead go-around, it could be assumed that the aircraft could safely fly straight ahead through D044, in 2011, it is not clear that such assumptions can be made. And since an inability to fly through the range could result in aircraft turning further left to avoid the range airspace, this could lead to aircraft flying closer to, or over, the nuclear power stations.

6.20 I conclude from the evidence presented in this section of my proof that:

- A number of changes have been made to the aviation environment and facilities around Lydd Airport since 1988. With the exception of the introduction of RNAV instrument approaches, these have either increased the operating constraints on the airport and/or reduced the margins of safety in relation to the risk of an aircraft crashing on the Dungeness power station.
- The NII's 1988 assessment started from a position that any flight path which involved aircraft pointing at the power stations was unacceptable. This led to a binding legal agreement that no aircraft, other than those under 5700kg in the visual circuit, could turn left on departure from runway 21.
- In relation to the current proposals, which permit all aircraft less than 5700kgs to turn left on departure from runway 21, it is not clear why NII has determined that this flight path is now acceptable.

- Similarly, it is not clear why in 1988 the NII placed a maximum 5.7 tonnes limit on aircraft using an arrival flight path for runway 03 over the town of Lydd, pointing at the power stations, whereas in their assessment of the current proposals, NII is content to permit much larger aircraft to fly a similar but even more critical flight path.
- The 1988 NII assessment was based on a cap on movements by jets and aircraft over 5.7 tonnes of 6,000 movements per annum. The current proposals would permit more than two and a half times those traffic levels. It is not clear why NII considers this acceptable, with fewer restrictions on flight paths now than were deemed necessary in 1988.
- Under the current proposals there are four scenarios in which an aircraft might follow a flight path which points at the power station – a situation which NII deemed unacceptable in 1988.

7. Practical constraints on the use of Lydd Airport by commercial airliners

7.1 This section of my evidence assesses practical operational and other constraints on the use of Lydd Airport by commercial airliners.

ICAO usability criterion

7.2 International standards for the design of airports are set out in Annex 14 to the Chicago Convention, published by the International Civil Aviation Organisation (ICAO). Paragraph 3.1.1 of Chapter 3 of ICAO Annex 14 recommends that "*The number and orientation of runways at an aerodrome should be such that the usability factor of the aerodrome is not less than 95 per cent for the aeroplanes that the aerodrome is intended to serve.*" "Usability factor" is defined by ICAO as "The percentage of time during which the use of a runway or system of runways is not restricted because of the cross-wind component." The UK has not filed a 'difference' from this particular ICAO recommendation, therefore it applies equally in the UK.

7.3 In the particular case of Lydd Airport, the usability factor necessarily has a wider definition than that set out above. This is because the airport has now accepted that Boeing 737/Airbus A319 type aircraft will not be able to land on runway 03 when the Lydd Range is active, and would therefore have to land on runway 21. The airport has stated that this would be possible in tailwinds of up to 10 knots. The usability factor for Lydd for these types of aircraft must therefore take account of times when the tailwind when landing on runway 21 is greater than 10 knots (or whatever the limit is for a particular aircraft at a particular time), as well as the frequency of crosswinds exceeding limits.

7.4 The Lydd Airport Master Plan, completed in 2003, assesses the usability of the airport against the ICAO 95% criterion. Using wind data for a three year period, the Master Plan calculated that the usability of the airport would be 99.75% if a maximum crosswind component of 20 knots is assumed, or 97.5% with a maximum crosswind component of 13 knots.

7.5 The assumptions about the maximum permissible crosswind relate to the ICAO Annex 14 provisions for aircraft whose "reference field length" is 1500 metres or more (for which the 20 knot maximum is used), or 1200 to 1499 metres (for which the 13 knot maximum is used). "Reference field length" is defined as the minimum field length required for take-off at maximum take-off weight, sea level, International Standard Atmosphere, zero wind and zero runway slope. For Boeing 737 and A319 in these conditions the reference field length is in excess of 1500 metres therefore it is appropriate to adopt the 20 knot criterion.

7.6 The wind data used as the basis for the calculations of usability factor in the Master Plan assumed that runway 03 would be fully usable for all aircraft types whenever the wind favoured it. In practice this is not the case since LAA now accepts that B737/A319 cannot land on runway 03 unless the Lydd Range is closed. The figure of 99.75% usability is based only on the frequency of crosswinds exceeding 20 knots on either runway 21 or runway 03, which would then prevent an aircraft landing. This figure should now be revised to additionally take into account instances of tailwinds greater than 10 knots on runway 21, which would also prevent a Boeing 737/A319 size aircraft landing at Lydd (according to Lydd Airport assumptions).

7.7 Table 4.2 of the Lydd Airport Master Plan showed the distribution of wind directions and speeds at Lydd Airport. I have analysed these data to determine the frequency of tailwinds exceeding 10 knots on runway 21. The proportion of winds which would generate a tailwind component of more than 10 knots on runway 21 was found to be 3.5%. Subtracting this from the Master Plan figure of 99.75% would give a revised usability factor of 96.25% - still higher than the ICAO recommended minimum of 95%.

7.8 As a validation check on the wind data in the Lydd Airport Master Plan, the METAR weather reports for Lydd Airport for the period 1 September 2009 to 31 August 2010 were obtained and analysed. In this period, the wind was recorded as having a direction and speed which exceeded a 10 knot tailwind on runway 21 on 15.6% of occasions. This is significantly in excess of the conclusions from the Master Plan data. If it is assumed that the Master Plan figure of usability, in terms of crosswinds alone, is accurate, then the additional consideration of tailwinds on runway 21 would reduce the usability factor for aircraft of Boeing 737/A319 size to 84.15% - significantly below the ICAO recommendation of 95%.

7.9 There are in any case numerous difficulties with adopting a standard figure of 10 knots for the limiting tailwind, as Lydd Airport has done. While the Boeing 737 (and most other airliner types) have been certified for commercial operations in tailwinds of up to 10 knots, and the Airbus 319 is certified for commercial operations in tailwinds of up to 15 knots, this cannot be taken to mean that airline operations can be conducted in these conditions irrespective of runway length, aircraft weight and configuration, instrument approach criteria and runway braking action (which is dependent on whether the runway is wet).

7.10 Landing in a tailwind increases the distance an aircraft requires to land and come to a stop. This is because a tailwind increases the aircraft's groundspeed. The aircraft touches down at a higher ground speed so uses more runway to decelerate and come to a stop. Deceleration on the runway is also slower because of the tailwind.

7.11 Where runways are sufficiently long, landing in a tailwind is not a problem. However, at Lydd, the length of runway 21, even after its proposed extension, is already marginal for regular commercial Boeing 737/Airbus 319 operations in nil wind. When there is a tailwind, the available runway length will frequently be less than the aircraft's required landing distance.

7.12 Commercial jet aircraft operators are required by European Union rules (EU OPS 1) to carry out calculations before every flight to ensure that, given the weight of the aircraft on landing at its destination:

- the aircraft will stop within 60% of the landing distance available on the expected runway in use;[14]
- when calculating the effect of a tailwind on the landing distance required, the operator must use 150% of the forecast tailwind component in their calculations;
- if the weather reports or forecasts indicate that the runway may be wet, calculations of landing distance required must be factored by, in normal circumstances, an additional 15%.

7.13 If the pre-flight landing distance calculations indicate that the aircraft cannot meet those criteria, the aircraft can still depart from its point of origin, but must have a designated alternate aerodrome to which it can divert, which meets all the landing distance requirements. At this stage the airline will make a commercial decision about the likelihood of having to divert and whether the flight should be cancelled, or the weight reduced sufficiently to permit the aircraft to stop within the available landing distance (by carrying less passengers, cargo or fuel).

7.14 In addition to the pre-flight calculations, before commencing an approach to land at the destination airport, the captain of the aircraft must also confirm that the landing distance required is less than the landing distance available there.

7.15 It will be seen from the figures above that if an operator is considering landing on runway 21 at Lydd in a forecast or actual tailwind of 10 knots, they must use a 15 knot tailwind in their calculations of the landing distance required. At a typical airliner landing speed of 130 knots, the landing distance increases by some 24% in a 15kt tailwind (compared to the nil wind case).

7.16 The usability figures in the 2003 Lydd Airport Master Plan do not take account of the impact of tailwinds on the landing distance required. They simply assume that Boeing 737s and Airbus 319s will always be able to land

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14 For turboprop aircraft the figure is 70%.

on runway 21 in a tailwind of anything up to 10 knots. Since the calculated landing distance required will increase by some 24% in a 10 knot tailwind (compared to the nil wind case) if the runway is dry, and by 43% if the runway is wet, the length of runway available will be critical.

7.17 To illustrate, Appendix 23 is an excerpt from the document *737 Airplane Characteristics for Airport Planning*, published by Boeing Commercial Aircraft in October 2005, showing the US Federal Aviation Regulations landing runway length requirements for a Boeing 737-800, using the maximum 40° flap setting.[15]

7.18 The 737-800 carries 184 passengers in the all-economy configuration. With a full load of passengers, the landing weight of the aircraft is unlikely to be less than 60,000 kg (132,000 lbs). At that weight, the graph shows that the aircraft requires a runway length of some 1500 metres in nil wind conditions on a dry runway located at sea level, and approximately 1720 metres on a wet runway at sea level in nil wind.

7.19 Applying an additional factor of 24% for a 10 knot tailwind (factored by 150% according to the rules), those figures would increase to some 1860 and 2130 metres.

7.20 The current authorised Landing Distance Available on runway 21 at Lydd is 1470 metres. Once the runway extension has been completed, this may increase to a maximum of 1799 metres. On the basis of these illustrative figures, then, a 737-800 with a full passenger load could not land on the current runway 21 in anything other than a headwind and dry conditions, and

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15 European Joint Aviation Authorities requirements are calculated slightly differently but are comparable. The principal operator of the 737-800 in the UK is Ryanair. Smaller numbers are operated by Thomson Airways. The Lydd Airport noise assessments are based on noise levels generated by the 737-800 - see March 2009 revised Environmental Statement for runway extension, Chapter 16, paragraph 16.4.13 – "It is the quieter 737-800 that is expected to be the largest public transport aircraft to use the airport after the development." See also March 2009 Revised ES Ch.16, Appendix 16.2, paragraph 4.3.2 – "It is the quieter 737-800 that is proposed for use at LAA."

could not land on the extended runway, assuming its full 1799 metre length is available for landing, in a 10-knot tailwind.

7.21 In order to operate a regular service into Lydd, any operator of a Boeing 737-800 would have to accept a payload penalty by only permitting booking of a proportion of the seats on the aircraft. The alternative – filling the aircraft and hoping that the weather conditions on the day will permit the aircraft to land – would lead to a high frequency of cancellations and/or diversions, which would be extremely costly to the airline.

7.22 Smaller versions of the Boeing 737, such as the 700, would also be likely to be constrained by the landing distance available on the extended runway 21 when landing in a tailwind. Calculations using Boeing 737 simulation software indicate that a Boeing 737-700 landing on runway 21 in a 10 knot tailwind, with a wet runway, would be limited to a landing weight of some 54 tonnes (compared to the maximum landing weight of 58 tonnes). With a tailwind of 15 knots, the permissible landing weight would go down to 47.7 tonnes. This is on the assumption that the full 1799 metres of runway 21 is available for landing. If, however, the landing threshold has to be displaced because of the configuration of the ILS (see below), the maximum permissible weight would reduce to 43.7 tonnes.[see Appendix 24]

7.23 There are other additional factors which will be taken into account by commercial airline operators when calculating the viability of landing on a runway as short as Lydd's runway 21. These will include the fact that the Instrument Landing System (ILS) for runway 21 is offset from the runway centreline by the maximum allowed 5° and the ILS glideslope is the normal maximum allowed of 3.5°. Flying an ILS approach in a tailwind with these parameters is challenging and is likely to lead to operators applying additional factors to the calculation of landing distance required. It should also be noted that the figures quoted above for the 737-700 and 737-800 assume the aircraft is configured for the shortest possible landing - 40° flap setting, auto spoilers, anti-skid etc. If any of these are for any reason not available, the required landing distance will increase further, and further restrictions on payload would have to be applied in order to meet the required safety margins for landing distance.

7.24 A useful indication of the commercial decision-making of a low-cost airline in relation to the acceptable minimum runway length can be found by looking at the Ryanair network. Among Ryanair's UK and Ireland destinations, the shortest Landing Distance Available (LDA) is on runway 04 at Belfast City Airport. This has an LDA of 1737 metres. While this is less than the proposed length of the extended runway at Lydd (although probably greater than the Landing Distance Available on runway 21, due to the ILS configuration), there is a crucial difference – at Belfast City, if there is any tailwind on runway 04, the aircraft can land in the opposite direction, on runway 22. This has a slightly longer LDA and is also the preferred landing runway for noise abatement reasons. The other key difference between Lydd and Belfast City is that the latter has instrument approach procedures to both runways.

7.25 Ryanair accepted payload restrictions on their operations out of Belfast City Airport for some time. However they always made it clear that they would prefer to have a longer runway at Belfast City. This was the principal reason for the airport authorities submitting a planning application for a 590m runway extension in 2008. However delays in holding a public inquiry into this proposal led to Ryanair announcing on 31 August 2010 their withdrawal of all services out of Belfast City Airport, stating that "we are not prepared to continue to operate at Belfast City with restricted routes and loads".[see Appendix 25]

Impact of the location of the ILS aerials

7.26 Lydd Airport has stated that all Boeing 737/A319 type aircraft will land at Lydd on runway 21, using the ILS. In addition they have stated that "(t)he ILS aerials will remain in its [sic] current position".[CD 1.21, Chapter 3, paragraph 3.6] This has significant implications for the ability of these types of aircraft to use runway 21, because the ILS localiser aerial - the horizontal guidance element of the Instrument Landing System - is currently positioned so as to guide aircraft to the existing runway threshold.

7.27 Currently, the Lydd runway 21 localiser beam is offset by 5° from the extended runway centreline. This is in order to ensure that aircraft following an ILS approach to Lydd remain clear of the Hythe Range danger area. A 5° offset is the maximum offset permitted under rules set by the International Civil Aviation Organisation (ICAO) and which the UK follows.

7.28 For offset ILSs, the localiser course – the ILS approach path – is required by ICAO standards (to which the UK conforms) to cross the extended runway centreline no closer than the point where the nominal glide path is at a height of 180 ft above the runway threshold.[see Appendix 26] This is to ensure that aircrew have sufficient time to align the aircraft with the runway centreline in the final stages of the approach. The current Lydd runway 21 ILS localiser course crosses the extended runway centreline at a point 900m from the runway threshold. With the proposed runway extension, the distance between the end of the runway and the intersection of the extended runway centreline and the ILS localiser course will reduce to 571 metres.[see Appendix 27].

7.29 With the glidepath angle of 3.5° and the glidepath crossing the threshold at a height of 47 feet, the point where the glidepath reaches 180ft above the runway threshold would occur 666 metres from the runway threshold. This is 95 metres further out from the threshold than the current localiser/runway centreline crossing point. Therefore the ILS localiser, in its unchanged existing location, will not be capable of meeting ICAO requirements for a runway threshold located at the northern end of the proposed 294m runway extension.

7.30 If the airport maintains its position that the ILS localiser aerial will not be moved, the only solution to this problem is to reduce the runway's declared Landing Distance Available. This would be achieved by displacing the declared runway threshold to the point where the relative locations of the threshold and the localiser/runway centreline crossing point meet the requirement for a minimum intercept height of 180ft. This will mean displacing the threshold by approximately 95 metres. The declared Landing Distance Available would then be no greater than 1704 metres, rather than the 1799m full length of the runway.[16]

7.31 This limitation of the available landing distance will be a further constraint on the operation of B737/A319 aircraft into Lydd. The illustrative figures for the Boeing 737-800 in paragraphs 7.17 to 7.21 above indicate that, if only 1704 metres was available, this type would be restricted to landing at Lydd (using an illustrative weight of 60 tonnes) when the runway was dry or, if the runway was wet, when the wind was either calm or providing a headwind on runway 21. If these conditions were not met, the aircraft could only operate with a further restriction of payload.

Runway width

7.32 Lydd Airport has one further limitation which will impact on the operation of Boeing 737/Airbus A319 size aircraft. Its runway has a width of 32 metres. This is narrower than the standard width of 45 metres at most commercial airports. Only three airports in the UK with runways long enough to support operations by jet airliners have runways narrower than Lydd's – Carlisle and London City with 30m, and Scatsta with 31m. None of these have aspirations to support operations by Boeing 737/Airbus A319 size aircraft.

7.33 The extended runway at Lydd will continue to be designated, as is the current runway, as a Code 3C runway. This means that it can support aircraft with a wingspan of up to 36 metres and a main undercarriage span of up to 9 metres. This includes the Boeing 737 and Airbus A319. The minimum recommended runway width for a Code 3C aerodrome is 30 metres.[see Appendix 28] But a runway as narrow as 32m, compared to the standard

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16 The exact dimensions will depend on the dimensions of the Runway End Safety Area at the end of the extended runway 21.

45m, presents a greater risk of an aircraft running off the edge of the runway in the event of an engine failure during the take-off run. This is particularly true when operating with a crosswind and/or on a wet runway. To address this risk, Boeing recommends reducing the maximum allowable crosswind when landing on narrow runways. Appendix 29 shows Boeing's recommendations for crosswind limits for a Boeing 737-700 landing on a 30m runway. Other recommendations include using reduced engine thrust for take-off and increasing the take-off decision speed. These measures will further reduce the weights at which airliners will be able to take off from the Lydd runway.

7.34 The width of the Lydd runway is likely to impose a further constraint on operation of larger airliner types from the airport. In the 2006 ES the airport stated that "(t)he proposed runway extension would involve the construction of approximately 294m of additional pavement to the northern end of the existing runway, resulting in a total runway length of 1799m with a further 150m starter extension beyond the threshold of Runway 21, See Figure 4.1 and 4.2. The runway width would, however, be retained at 32m and as the starter extension is not recognised by the CAA as part of the runway, the airport will remain a CAA Category 3C overall." [CD 1.17, Chapter 4, paragraph 4.2.1]

7.35 While it is in strict terms true that the physical length of the runway, as listed in the AIP and other publications, does not include the length of any Starter Extension, it is not the physical length of the runway that determines the aerodrome reference code, but the greater of the Take-Off Distance Available (TODA) or Accelerate-Stop Distance Available (ASDA). The declared distances of both the TODA and the ASDA for the extended runway 21 will therefore include the length of the Starter Extension, as CAP 168 makes clear [see Appendix 30].

7.36 Since ICAO Standards and Recommended Practices do not allow for a runway narrower than 45 metres to be designated in any Code higher than 3, this means that the maximum length of the Lydd runway should be 1799 metres – the upper limit for Code 3. Since the inclusion of the Starter

Extension would result in the TODA and ASDA for runway 21 being in excess of the upper limit of 1799m for a Code 3C runway, this would suggest that Lydd could not retain its Code 3C designation. However, the CAA has historically given a UK-specific dispensation to allow airports to declare distances up to 10% above the upper limit of the runway code as defined by ICAO.

7.37 In Lydd's case this 10% dispensation would mean that the maximum declared distances on the extended runway would be 1979 metres. The physical length of runway 21 available for take-off will be 1799 metres plus the starter extension of 150m, giving a Take-Off Run Available (TORA) of 1949 metres. With the additional 10% CAA dispensation, the Take-Off Distance Available (TODA) could extend a further 30 metres beyond the end of the tarmac, to the maximum allowable 1979 metres. This would mean that all but 30m of the current Clearway of 176 metres at the end of runway 21 could no longer be counted towards the TODA for runway 21. In other words, if the airport was allowed, in calculating the declared TODA for runway 21, to use the whole of the existing Clearway beyond the south end of Runway 21 as well as the 294m runway extension and 150m Starter Extension at the north end of the runway, the resulting TODA would be 2125 metres. However, because the runway is less than 45m wide, Lydd can only declare a maximum TODA of 1979 metres.

7.38 For departures on runway 03, the same upper limit for a Code 3C runway, with a 10% CAA dispensation, would apply, giving a maximum Take-Off Distance Available of 1979 metres. This is the same as the TODA for the existing runway 03 [see CD 16.1, at EGMD AD 2.13], so the runway extension would confer no additional benefit for the airport in that respect. However, the physical length of tarmac available would be greater, so the TORA for runway 03 would increase from the current 1470 metres to 1799 metres.

7.39 Until 13 April 2006, the TODA for runway 03 was 2235 metres. Because of the limits outlined above in relation to Code 3C runways, the extended runway will not be able to match that figure. The TODA for both runways, after the runway extension, will be limited to 1979m.

7.40 The proposed Runway End Safety Area at the north end of the runway is the ICAO/CAA recommended length of 240m for Code 3 and 4 runways [CD 1.19, Figure 3-6]. Assuming that a Clearway could extend as far as the northern end of the runway 03 RESA, that would allow for a maximum runway 03 TODA of 2099m (physical runway length of 1799m plus runway strip of 60m plus RESA of 240m). However it will not be possible to declare a runway distance of this length because the maximum permissible by the CAA for a Code 3C runway is 1979m.

7.41 I conclude from the evidence presented in this section of my proof that:

- Wind data indicate that Lydd Airport would not be able to meet the ICAO recommended figure of runway usability on 95% of occasions, for aircraft of Boeing 737/A319 (Group 1) size.
- The airport proposal that Group 1 aircraft would land on runway 21 in a tailwind of up to 10 knots takes no account of the environmental and aircraft configuration conditions which affect an aircraft's ability to land in a tailwind in particular circumstances.
- Data from Boeing indicate that a Boeing 737-800 with a full passenger load could not land on the extended runway 21 at Lydd in a 10 knot tailwind. Limitations on payload would be required.
- Boeing 737-700 aircraft are also likely to have to apply payload limits when landing on the extended runway 21 at Lydd, particularly when the runway is wet.
- When the runway extension is completed, the existing Instrument Landing System will not meet the ICAO requirement that the ILS localiser course crosses the extended runway centreline at a point where the ILS glidepath is at a height of at least 180 feet above the runway threshold. This will mean that the runway 21 landing threshold is likely to be displaced by some 95 metres, thus reducing the declared Landing Distance Available and therefore reducing

further the maximum weight at which aircraft can land on that runway, particularly in a tailwind.

- The Lydd runway is and will remain 32 metres wide, compared to the standard width for commercial airport runways of 45m. This will result in further restrictions on take-off operations from this runway by larger aircraft, particularly in crosswinds.
- CAA policy dictates that the width of the runway at Lydd prevents any of the declared runway distances – TODA, TORA, LDA or ASDA – being greater than 1979 metres. This will mean that some of the existing declared runway features will not be available after the runway extension is completed, thus placing further limits on operations out of Lydd by larger aircraft.