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

Supplementary Proof of Evidence

ESR Technology Reports

TRUDY AUTY, BSc, ARCS

FOR LAAG

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

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

April 8th, 2011

NUCLEAR SAFETY CONFLICTS
SUPPLEMENTARY EVIDENCE

CONTENTS:

Introduction

Recap Of Objectives

Misrepresentation Of The 'Current Situation'

Reports Confirm A Step Change In Risk Posed By LAA Expansion

Risk Assessment Criteria

ESRT's Methodology Cautions (Including AEA & NATS InabilityTo Represent Curved/Non-aligned Flight Paths)

Model Failures And Underestimates

Systematic Bias OverstatesThe Background To Airfield Crash Rate Ratio

Summary

Conclusions

Appendices:

1) **Crash report Shackleton**
2) **Crash report Hercules**

NUCLEAR SAFETY CONFLICTS
SUPPLEMENTARY EVIDENCE

INTRODUCTION:

1) This report contains supplementary evidence following the Health and Safety Executive's [1] decision to release:

   a) Lydd Airport Planning Application; Review of Dungeness B Aircraft Impact Hazard Analysis, July 2007, (CD 13.9) – The ESRT 2007 report.

   b) Dungeness Aircraft Crash Risk: Updated Review Of Assessment, February,2009, (CD 13.10) – The ESRT 2009 report.

2) Both the 2007 and 2009 report were prepared by the external consultant, ESR Technology (ESRT), to review the increased probability of a major nuclear accident that would result if Lydd Airport's planning applications were to be approved. Both look at the relevance of the modelling and the integrity of the data which has been applied.

3) ESRT states its objective was to ensure that the standard (AEA) methodology had been applied correctly and *'To evaluate whether, taking account of the limitations and uncertainties inherent in the standard methodology, the risk estimates ...were sufficiently reliable to allow sound judgements on the acceptability of the proposed developments to be made'* (CD 13.9, Page 19, second paragraph)

4) Since ESRT is a continuation of AEA then this work could be construed as a defence of its original methodology [2] rather than an independent review. However these reports do confirm, beyond doubt, the failure of all models to represent the probability of an aircraft collision from Lydd based traffic. They also confirm that aircraft crash data was wrongly assigned and is statistically meaningless.

5) Despite having identified a whole raft of deficiencies, ESR Technology tries to assert, beyond reason, that their original numerical model can still be applied as the foundation of a nuclear safety assessment at Lydd. We demonstrate that it cannot, that the whole assessment structure has been invalidated to a point where there is clearly no basis for the Secretary of State to make a sound judgement other than to refuse these planning applications.

[1] On 1st April 2011 the Nulcear Installations Inspectorate (NII) was incorporated into the Office Of Nuclear Regulation (ONR). However, as most previous references and communications have been with HSE or NII, these names have been maintained throughout the document for continuity.

[2] The original AEA report was confirmed by NII to be the Byrne model (LAAG/3/A, Letter 3, note 3).

RECAP OF OBJECTIVE:

1) Letters from the NII to the Autys, to LAAG and to other residents state that if a large aircraft were to strike the nuclear power stations then it has the potential for causing a major nuclear accident resulting in more than 100 fatalities (reference LAAG/3/B Letter 1, note 1) The severity of the outcome has been reconfirmed in the opening sentence of ESRT's 2007 report (CD 13.9, page 2).

2) Put in context, the outcome of such an aircraft strike on the Dungeness nuclear power stations could match or exceed that of the recent Fukushima disaster[3].

3) Given that the magnitude of the outcome is not in debate, the only questions which the Secretary of State should now consider are:

    a) Whether the increased probability of a major nuclear accident resulting from this development is acceptable and justifiable to society.

    b) Whether this increase is significant when compared with the background risk posed by aircraft flying over head[4].

4) In making this assessment he must be mindful of the requirement to 'Err on the side of caution where there is **uncertainty** and where the safety of the general public is concerned' which means the default position should be to refuse these plans unless the increased risk can be accurately assessed and its acceptability justified beyond reasonable doubt.

5) This supplementary evidence shows that it cannot. It demonstrates inadequacies and uncertainties within NII's methodology, the extent to which the increased risk is likely to exceed acceptable levels and its dominance over a notional background crash risk.

6) Most importantly it confirms that the numerical assessment of the risk posed by this development has been grossly understated simply because the model doesn't stretch as far as the nuclear site which it was intended to assess. It cannot cope with landing overruns which extend as far as the nuclear power stations, putting all such manoeuvres to zero in the crash rate assessment. This is not just a case of poor representation. It means that **none** of the landings on 21, or their associated go arounds, have been accounted for despite these manoeuvres constituting the vast majority aircraft landings at LAA.

[3] International Event Scale rates a major nuclear accident as number 7 on a scale of 1 to 7. Fukushima has so far only been rated as number 5, an 'accident with wider consequences' although there appears to be international debate about this classification.

[4] Whilst there might be debate about the relevance of the comparison with the background crash risk it is recognised that this is a test which the NII applies. Our evidence in LAAG /3/A paragraphs 48 to 54 explains that it is not an unreasonable comparison to make **provided** that the methodology is sound and the data statistically meaningful. This supplementary evidence shows that it is not.

7) Moreover, ESRT admits that simple numerical crash rate models are unable to represent the curved/non runway aligned flight paths which are prevalent at LAA. They are clearly concerned by runway 03 landings which involve a turn towards the nuclear power station and admit that the standard model will have underestimated the risk posed by such manoeuvres.

   Put with the failure to account for any landings onto runway 21, these reports confirm that virtually no landings at LAA are represented by the numerical assessment which NII used as a basis for its decision not to object.

8) All of this is set against the incredible revelation that the exceptional bird strike hazard associated with aircraft operations at Lydd has been ignored. Neither report makes any reference to the RSPB reserve, the SPA or the fact that the whole area is under one of the largest migratory bird routes in Southern England. It is clear that birdstrike has not been considered and cannot have been numerically assessed for reasons given in my original evidence (LAAG/3/A paras 90-96) and because runway 21 landings are all set to zero[5],.

This supplementary evidence considers these issues in more detail.

MISREPRESENTATION OF THE 'CURRENT SITUATION'

9) Firstly it is important to establish the baseline for the comparison of increased risk. NII guidelines state that any new risk should be compared with the current situation (SAPs, ALARP guidance, para 29). The ESRT 2009 report reveals that LAA had misrepresented the status quo to NII thus negating the nuclear inspector's decision not to object.

10) The common ground statement between LAAG and LAA (CD 4.4) agrees that aircraft over 5.7 tonnes only represent 1% of total aircraft movements which equates to 220 movements per year. There is clearly little prospect of the airport growing significantly above this figure given the inherent constraints which are described in Spaven's evidence (LAAG/10/A) and the external factors mentioned by Ms Barton in (LAAG/8/A).

11) Therefore the increase in probability of a major nuclear radiation release should have been referenced to 220 movements per year of aircraft weighing over 5.7 tonnes, not 9,000 per year (25 per day over 360 days derived from CD 13.10, page 4, table 3) which LAA told the NII would be its 'non development' throughput by 2009.[6]

[5] Birdstrike cannot be implicit in a model which fails to count the relevant flight movements; landing overruns and go arounds in particular.

[6] Planning applications were filed at the end of 2006. LAA told the NII that, even without planning permission, it would grow from virtually zero to 9,000 aircraft movements per year of > 5.7 tonnes by 2009.

12) This is clearly not credible and requires the entire nuclear safety case to be rebased accordingly.

CONFIRMATION OF STEP CHANGE IN RISK POSED BY LAA EXPANSION

13) In our original evidence, LAAG/3/A page 6, paragraphs 24 to 29, we postulate that these planning applications would introduce a step change in the risk of a major nuclear accident derived from LAA based traffic. This was because, regardless of the probability of an aircraft crash, there would be a step change in the off-site radiological consequences.

14) This is now confirmed by the ESRT 2007 report. Its opening paragraph,page 2 states:

The assessment of the aircraft impact that supports the current safety case considers the risk of a large radiological release as a result of an aircraft impact with the pressure boundary causing a significant breach of the pressure boundary. The frequency of aircraft with the potential to lead to significant radiological release was estimated to be(redacted) per reactor year.

The risk (of significant radiological release) relates to the impact of heavy military and commercial transport aircraft causing direct mechanical damage to the bioshield and fuelling machine (shaded area shows words under the poorly executed redaction)

15) It goes on to say in regard to light aircraft operating from LAA that

Essentially this latter case is based on a light aircraft crash impact being insufficient to cause significant direct damage (redacted) and any damage to other safety critical systems being sufficiently localised and subject to sufficient protection in order for a significant radiological release to be avoided'

This confirms that the presence and number of light aircraft is considered to be irrelevant in terms of assessing the increased risk posed by this expansion as it is assumed that they make no contribution to the probability of a significant radiological release[7].

Therefore an increase in flight movements from 220 small transport aircraft to over ten thousand small and large transport aircraft movements per annum, in the

[7] This also proves that NII's assertion in its briefing note (LAAG/4/C, Appendix 19, page 4) that the increase in risk posed by large commercial jets can somehow be offset by a reduction in the operation in light aircraft is wrong. Not only because LAA states there will be no reduction but also because one cannot offset the risk posed by the introduction of large aircraft taking off and landing at the airport by the activity of light aircraft when the latter are not considered heavy enough to cause a significant radiation release.

developed case[8] will clearly represent a step change in the probability of a major nuclear accident derived from LAA based traffic.

ASSESSMENT CRITERIA

16) ESRT uses the Basic Safety Objective (BSO) as the marker of acceptability in both its 2007 and 2009 reports.

17) However, as noted in my original evidence (reference LAAG /3/A 38 to 40), there is a problem in trying to assign numerical hurdles as the NII failed to review the BSO in light of the potentially catastrophic consequences.

18) In the NII's 'Numerical targets and legal limits in Safety Assessment Principles For Nulcear Facilities' ,paragraph 51 states

In the case of accidents where the consequences are very much larger than (SAPs) target 9, 100 fatalities, then there may be a need to demonstrate a correspondingly lower predicted frequency of occurrence.

19) This should have driven the NII to reduce the BSO to less than 10^{-7}crash per year. It is inconceivable that NII should have failed to carry out this due process, particularly in light of ESRT's revelation that none of its models are able to represent the risk posed by airport expansion at Lydd.

20) Unless the assessments could prove ,with a high degree of certainty, that the increased probability of aircraft collision was **well below** 10^{-7}, one has to assume some orders of magnitude below, then there are clearly no grounds for taking a gamble with public safety by passing these plans.

21) Moreover such gates cannot simply be applied by rote. Aside from any numerical estimate, there is a need to consider the integrity of the modelling and quality of the data which has been applied. A need to stand back from the equations and consider the overall risks and drivers within the case.

ESRT'S METHODOLOGY CAUTIONS

22) By the time it reached the 2009 report, ESRT had recognised that simple crash rate modelling cannot represent the probability of an LAA based aircraft colliding with the nuclear site[9]. Neither the AEA or NATs models are able to deal with the curved/non runway aligned flight paths which represent virtually all incoming and outgoing traffic at this airport.

Neither the AEA or NATS models attempt to take account of curved flight paths (CD 13.9, Page15)

[8] Rises to over 30,000 small and large transport aircraft movements in the developed case for LAA's 2Mppa master plan projections.

[9] There are signs that ESRT is starting to realise that a complex multi-dimensional problem cannot be represented by a simple two dimensional plot although this was not explicitly stated.

23) ESRT confirms that, whilst the NATS model may be a good representation of the risk associated with the public safety zones (' *because the flight paths over the limited areas to which the zones extend are generally runway aligned,* CD 13.10, page 8, penultimate paragraph) it cannot represent those locations, such as the Dungeness site, which are further out but which must be considered: *However where lower risks are of concern at sites further from the runway threshold, the simplifying assumption may not provide a fair estimate of the crash risk. Its validity may also break down where there are more severe constraints (CD 13.10, page 8)*

24) Therefore ESRT's 2007 assertions that NATS might be a better model to consider than AEA is meaningless, as in practice neither is able to represent the probability of an aircraft crashing onto the nuclear site.

25) The 2009 report discusses (one cannot place any greater weight on the text than this) other models which might be used to evaluate constrained airfield approaches but admits that they all have limitations[10]

26) ESRT confesses, on CD 13.10, page 10, that such modelling is inadequate as it

Doesn't take account of all accident scenarios....may not adequately account for other potentially relevant scenarios such as disorientation and loss of positional awareness, subsequent deviation from the flight path and controlled flight into terrain.....for the current application it may fail to provide reliable estimates of risks further from the nominal (flight) path that are of potential significance.

27) The 2009 report goes on to admit that as no single model represents the probability of an aircraft collision at LAA, it highlights the need to develop a new methodology (reference CD13.10, discussion under 3.2.3 on page 12). Having established that it could not proffer a model which is fit for purpose, one would have expected ESRT to advise NII of the need to refuse these plans. Instead it proposed a 'model cascade'.

28) The idea of this 'stick and patch' approach is to start with the AEA numerical model and then evaluate, on the basis of a qualitative assessment, whether it is likely to over or under-estimate the risk.

If it has underestimated the risk, to then proceed with an empirical modelling approach for curved flight paths developed by NLR and if that is likely to underestimate (on the outside of curved paths) then go on to attempt an assessment using the DNVT mechanistic model.

[10] It is assumed that the DNVT and NLR models which were developed in the early 1990s are the subject of ESRT's comments in CD 13.9, page 15, middle paragraph ' *Some models have attempted to take account of curved flight paths but there are technical difficulties associated with the approachs and doubts about their validity.*

29) To suggest the application of such an untested and tenuous approach is not credible. If the methodology is not fit for purpose then one cannot adopt a process which keeps picking out information from a patchwork of models, until the assessor reaches an unqualified estimate derived on a 'best efforts' basis.

30) Since the starting point of this process is an assessment of whether the AEA model would have over or underestimated the risk and the AEA model is incapable of assessing the risk posed by Lydd based traffic, it means that the whole model cascade collapses because it has no foundation.

31) The following evidence demonstrates the extent to which the original AEA model has underestimated the risk posed by airport expansion at LAA. It then goes on to demonstrate a systematic bias in the model which serves to overstate the ratio of background to airfield crash rates i.e. NII can no longer claim that the risk is dominated by aircraft flying overhead.

UNDERESTIMATES DUE TO SPECIFIC NATURE OF THE SITE: FAILURE TO EVALUATE THE EXCEPTIONAL BIRDSTRIKE HAZARD

32) The ESRT 2007 report cautions (CD 13.9, page 18, 4.6) that '*given the inherent limitations of risk modelling of this type and the related uncertainties, it is important to take care when interpreting the results of quantitative risk modelling ...having regard to* ***the specific nature of the site*** (my emboldening)

33) Despite stating the need to account for local conditions, both reports fail to make any reference to the wetland conservation area which lies between the airport and the nuclear power station. It is clear that no consideration has been given to the exceptional birdstrike risk associated with this particular location. The birdstrike hazard has already been discussed in my evidence (LAAG/3/A) as well as in a number of the ornithology reports.

34) The presence of this severe and unpredictable hazard is reason alone for these plans to be refused. ESRT's failure to even mention bird strike undermines its credibility as a commentator on the nuclear safety case.

UNDERESTIMATES FROM A FAILURE TO CONSIDER THE SPECIFIC NATURE OF FLIGHT MANOUEVRES AT LYDD.

35) The ESRT caution (CD 13.9, Page 18. 4.6) goes on to say '*Given the inherent limitations of risk modelling of this type and the related uncertainties it is important to take care when interpreting the results of quantitative risk modelling...having regard to the specific nature of the site* ***and operations concerned'***

36) ESRT's 2007 report admits that the AEA model will underestimate the risk associated with a number of the operational scenarios at Lydd. This section deals with these higher risk scenarios together with flaws in the model which ESRT has overlooked.

No landings on Runway 21 are counted because the model falls short of the nuclear site:

37) ESRT states:

Since Dungeness B lies at a greater distance than 3.275 km from runway 21 threshold then the crash risk for a runway 21 approach is zero (CD 13.9, pages 26/27)[11]

And goes on to admit that this is a limitation of the AEA model .

38) This means that large aircraft (Boeing 737, A319 and A320s) landings have not been accounted for within the standard model, despite representing the greatest threat to public safety, simply because the model does not stretch out as far as the nuclear power stations which it was intended to assess. It truncates at a distance of 3.275km beyond the runway threshold.

39) Any aircraft which had reached this longitudinal distance could be over the bird reserve or SPA, facing the added threat of birdstrike over an area where hazardous birds, such as geese and swans, are now being protected rather than discouraged. So, rather than diminishing at 3.275 m, the risk would be increasing again due to this additional hazard which is now less than 2 km from the nuclear site. It demonstrates both ESRT and NII's failure to assess the complete system (airport, bird reserve, two MOD firing ranges and two nuclear power stations) as well as a mistaken perception that the runway is the only origin of risk.

40) As the majority of 'group 2[12] landings will also be on runway 21 together with 70% of all other aircraft over 5.7 tonnes[13] (based upon prevailing winds) it means that the standard model grossly underestimates the crash risk posed by LAA traffic because it artificially eliminates the majority of landings at the airport[14].

ESRT admits the model underestimates the risk posed by 03 landings:

41) This leaves landings onto runway 03 which constitute a relatively small proportion; being those aircraft that are able to land on this runway when the prevailing winds dictate and subject to the activity of the Lydd Ranges which are in use 300 days per year (82%), often firing up to 23.00 hrs.

[11] This is consistent with Byrne model, CD 13.1 ,page 15 which states that the model goes to zero for values of x less than -3.75 km and Figure 13 on page 74 which shows the landing accident co-ordinate system as defining the distances beyond the runway threshold (e.g. overruns) as having a negative prefix.

[12] As defined by the aircraft operations evidence in this inquiry; broadly equivalent to the heavier end of the nuclear industry's group 3 'small transport aircraft'.

[13] Bearing in mind that the assessment rules out impacts from aircraft below 5.7 tonnes on grounds that these are not capable of inducing a significant radiological release CD 13.9 page 2

[14] Although there is reference to NATs ability to stretch beyond 3.275 km there is no evidence to suggest that the NATS numerical assessment included runway 21 landings as this would have created a completely different set of assumptions for each model applied i.e. it would not have been an 'apples for apples' comparison.

42) In its 2007 executive summary (CD 13.9) ESRT admits:

Para 5: *Due to the exclusion zone around the Dungeness Nuclear site and the Lydd ranges, a standard runway aligned approach to runway 03 is not possible and the standard risk model is not applicable to these operations.*

Para 6: *Runway 03 landing involves a flight along the runway 21 approach path followed by a flight over the runway, then a 180 degree turn onto a runway path.* ***This procedure may lead to a greater likelihood of a crash onto the Dungness Site than would have been the case than if the aircraft was on a runway-aligned path throughout.***

Para 7: *Whereas we can develop qualitative arguments, based upon the considerable distance from the Runway 03 approach path and the Dungeness B site to support the view that the runway 03 procedure is unlikely to lead to a high probability of a crash at the site, developing quantitative estimates for the probability of a crash at the site associated with Runway 03 approach operations presents significant difficulties.* ***Estimates using the standard AEA Technology methodology are not reliabe***

43) ESRT later confirms in its 2009 report that the point of the trajectory at which the aircraft would be heading towards the nuclear site is only 3km from the power stations (CD 13.10, page 11, last paragraph)

44) ESRT's attempts to evaluate this exceptional hazard cannot be assessed due to redactions. However the trajectory modelling supports the fact that an aircraft which encounters a problem on the critical point of the turn is likely to continue forward along a tangent towards the nuclear power station in either the catastrophic or 'with control' case (CD 13.10, page 9, penultimate paragraph)

45) ESRT does acknowledge in its 2009 report that the majority of all landings onto runway 03 involve a turn towards the nuclear power station, including those making a visual approach

'For both these practises, aircraft will, for some part of the approach at least be heading in a south-easterly direction towards the Dungeness Nuclear Power Station Site...' (CD 13.10 page 11, last paragraph)

46) Put with the inability to assess runway 21 landings, this means that virtually no landings are represented by the standard AEA numerical model which ESRT employs as the foundation of its model cascade.

ESRT Admits Runway 21 'Go Arounds' Present A Higher Risk:

47) Not only has the AEA model failed to represent the risk posed by aircraft landings at Lydd, it has completely omitted runway 21 go-arounds from the assessment.

The ESRT 2007 report (CD 13.9)Page 27 notes in relation to go-arounds from runway 21:

'if it can be argued that there is an increase in the likelihood of an aircraft needing to elect to go-around at Lydd as compared with the standard operational data set on which the risk model is based, then this provides a basis for arguing that there may be an increased risk of a crash at the site, compared with the predictions of the standard model.

48) Firstly there is a problem with the logic of this statement. When ESRT refers to '*an increased risk of crash at the site, compared with the predictions of the standard model'* it assumes that the empirical model will take account of a certain percentage of go arounds for every so many landings i.e. that these will be implicit within the results.

49) However, the truncation of the AEA model at 3.275km artificially puts all 21 landings to zero within the numerical assessment. If the landings have been put to zero it follows that there can be **no** representation of any go arounds. So it is not a case of considering whether go arounds are above average; it is that they haven't been represented in number or complexity anywhere within the model.

50) Moreover, it is clear both from the evidence provided by Malcolm Spaven (LAAG/10/A, page 43) and from the letter provided by CAA's Group Director Of Safety Regulations (LAAG 3/B/letter 4, note) that the **combination** of conditions for a runway 21 approach at Lydd Airport (steeper descent angle, offset approach and tailwind) will be conducive to a greater number of go arounds.

51) This applies to the larger transport aircraft which are more likely to cause a major nuclear accident in the event of a collision and will be a consideration for upto 30% of all such flights.[15]

52) In other words we have a situation where the CAA has said that conditions at Lydd are conducive to increased go arounds, where ESRT admits that such manoeuvres could result in a higher probability of aircraft collision and yet they are not accounted for anywhere in the assessments. This scenario has not been considered using any other of the models in either the 2007 or 2009 ESRT reports, demonstrating the fundamental flaw in AEA's model cascade. If a gross underestimate of risk is not recognised at stage one then it continues to go unnoticed throughout the entire assessment.

53) This risk would increase if LAA were to employ one of its suggested solutions for the ILS location vs height problem. It argues that, being hampered in moving the ILS to an appropriate position, it could overcome the problem by increasing the height of the ILS to 65m. Even if the CAA were to approve such a height, the only way in which a large commercial aircraft, such as Boeing 737, could then land with a full payload would be if the aircraft steepened its angle of descent for the

[15] The wind favours runway 03 for 30% of the time and it is agreed that Boeing 737s and A319/320s will land with a tailwind on runway 21 when the Lydd range is active.

final, post ILS, part of the approach; thus negating the stabilisation which the ILS had provided.

54) Whether such a manoeuvre could be approved or implemented is questionable but in any case this destabilisation would further increase the probability of a go around and hence the probability of a large aircraft collision with the nuclear site.

Landing Too Far Down The Runway:

55) ESRT makes further comment on tailwind landings saying:

'Alternatively, if (an aircraft) lands too far down the runway to stop safely and attempts take off again, perhaps having suffered some damage, again representing a greater risk to the site than the standard model'

56) Referring back to the airport's ILS position vs height dilemma, Mr Spaven noted that the standard procedure for an aircraft which has stabilised itself using the ILS and is continuing with a visual approach is to use the precision approach paths indicators which would guide the aircraft down on the prescribed descent angle, in this case 3.5 degrees. However, if the height of the ILS is increased to 65 metres, then this descent angle would place the aircraft further down the runway than the threshold. This not only negates the benefit of a runway extension, but has the potential to increase the probability of a collision with the nuclear power station as ESRT describes above.

ESRT AdmitsThat A Larger Offset Angle (RNAV) Approach Would Increase the Probability Of A Collision With The Nuclear Power Stations

57) The 2007 report, CD 13.9, page 4 last paragraph to page 5, states:

As discussed, the current approach procedures involve a flight path that is offset from the runway centre line. The offset is such that the extension of the approach path to the SSW beyond the landing threshold is offset from the Dungness site than would be for the case for a runway aligned flight path. The characteristic might be expected to have some influence on the impact probability..... We would expect that any change in future operations is most unlikely to increase the angle of offset of the approach and that, if any change in approach procedures were to occur, this would be more likely to reduce and perhaps eliminate the offset. Assuming the use of the current offset approach procedures into the future would therefore, not be expected to be in any way optimistic, as far as the risk of impact at Dungeness is concerned and maybe pessimistic.

58) ESRT has been proven wrong in its assumption that 'if anything the offset angle is likely to reduce'. The angle of the ILS approach cannot be reduced as it is necessary for aircraft to avoid flying into the restricted airspace over the Hythe military range. However it appears that ESRT has not been informed of the introduction of the RNAV approach which has a 14 degree offset which further aligns it with the nuclear power stations. Leaving aside the remarkable logic that, because the AEA model doesn't stretch as far as the nuclear site then it cannot be sensitive to approach

angle, ESRT does concede that larger offsets are likely to increase the probability of aircraft collision.

59) In fact in the conclusion of its 2007 report, page 31, it notes

A straight rather than offset approach would generally be considered safer and preferable it possible. It is worth noting that the offset approach angles employed for the approach procedures mean the flight path on approach is slightly more towards the site that would be the case for a runway aligned approach, In the event of a missed approach during an attempted Runway 21 landing and a failure to follow appropriate procedures to avoid the nuclear exclusion zone it might mean that aircraft would fly closer to the site than might otherwise

60) Obviously the writer was not aware that this scenario has been made even more dangerous by the increase from a 5 to a 14 degree offset in the RNAV approach. Mr Spaven has explained that aircraft upto group 1 Boeing 737s and A320s might use the runway 21 RNAV approach under certain circumstances; none of which have been factored into the nuclear risk assessment.

61) The points raised above demonstrate how marginal the situation is at LAA. How a decision or compromise in the operational set up at the airport can have a nuclear safety consequence which will not be considered or assessed in any appropriate forum. There is no mechanism to track and evaluate such changes post the planning stage and those making them are not aware of the impact of their decisions.

Model Incorrectly Assumes Full Pilot Avoidance

62) In its 2007 report, CD13.9, page 17, ESRT states

'Pilot avoidance of critical targets may be a significant factor where some degree of control is available after development of the scenario that may ultimately lead to an impact with the ground but is not taken into account by the model.'

63) This statement is wrong. The aircraft reliability figures in this report are those derived by Byrne and Jackson in 1992, (based upon 1979 to 1989 airfield crash rate data). Any aircraft which merely lost an engine, landed without loss of life or took some avoidance action was **excluded** from that data base (reference LAAG/3/A para 53). This means the model has, de facto, made an assumption that in 100% of the scenarios where the pilot retains some control then he or she will miss the nuclear power station. This is an assumption which becomes less valid, the closer the event or chain of events is to the nuclear site. It is also at odds with earlier nuclear safety reviews, such as the revised assessment of Dungness A in 2005, where it was assumed that the pilot avoidance only works in 30% of cases, not 100% as implied by this model for Dungeness B.

Although the 2009 ESRT report refers to an updated airfield crash rate data base, it makes no reference to changes in the screening criteria which are assumed to remain as per the Byrne and Jackson report.

Skidding Not Factored Into The Numerical Model.

64) Although ESRT's 2007 report describes and is clearly concerned about the skidding hazard, it has failed to take account of it within the mathematical model. It has clearly made some numerical assessment on CD 13.9, Page 29 which has been redacted.

65) However, ESRT admits that skidding could increase the impact rate by a factor of ten based upon average skidding distances of 550m (CD 13.9, Page 29). Multiplying the NII's crash rate figures for Lydd in the developed case by 10 brings the 'with skidding' crash rate to > 1 x 10^{-7} . This means the airport contribution would exceed the basic safety objective[16] on its own, without any contribution from the back ground crash rate.

66) Although ESRT points out that other buildings might provide shielding, one might have expected them to present the x10 as a conservative boundary case which the presumably have behind the redaction. Put together with:

-The factors described in 31 to 66 above

-The failure to include any contribution from Dungeness A.

-The failure to include any contribution from the railhead.

then it is clear that the probability of a major nuclear accident derived from Lydd based traffic in the developed case has been grossly underestimated . The NII can no longer claim with any certainty that it falls below its own safety marker.

SYSTEMATIC BIAS OVERSTATES THE RATIO OF BACKGROUND TO AIRFIELD CRASH RISK.

67) ESRT's caution (CD 13., Page 18, 4.6) finishes by saying *Given the inherent limitations of risk modelling of this type and the related uncertainties it is important to take care when interpreting the results of quantitative risk modelling...having regard to the specific nature of the site and operations concerned and* ***the biases inherent in the models***

68) NII makes the argument that, as society has accepted flying in general, then if the risk posed by Lydd based traffic is not significant when compared with a notional background crash rate, it would have little grounds for refusal. Until now, the NII has put this forward as a primary reason for failing to object. However we can

[16] Noting that the Basic Safety Objective should, in any case, have been reviewed and tightened in the light of intolerable consequences and the inadequacy of the various models applied.

deduce from these ESRT reports that airfield crash rate will be the dominant factor.

69) The reports identifies, albeit indirectly, a systematic bias within the crash rate modelling and a bias which results from incorrect assignments within the crash rate data bases.

AEA Model Bias:

64) The factors which are listed under 'Impact Area Model and Consequence Analysis' listed on page 17 of the 2007 ESRT report all serve to overstate the background to airfield crash rates.

65) ESRT admits that the model doesn't distinguish between the descent angles associated with a background vs an airport related event. It goes on to say that the numerical assessment does not account for skidding issues which will be greater for shallower angle impacts (Byrne model CD 13.1, confirms that skidding is only applicable for descent angles of less than 15 degrees). These are more likely to be associated with airport related movements and not from a background crash which assumes a complete loss of control in the aircraft's en route phase. As skidding could increase the airfield crash rate by a factor of 10 it means its ratio to a notional background rate will be understated.

67) The model does not account for the fact that the effective target area increases with decreasing descent angle. This means that the effective target area (and hence crash rate) will be greater for airfield traffic than for a background crash, again skewing the model in a way which overstates the background contribution.

68) The model is skewed because crashes where the pilot retains some control of the aircraft are screened out from both the airfield reliability and background data bases. The latter is reasonable as the pilot would have more time to take diversionary action. The former is not and the assumption becomes less valid the closer the event(s) are to the nuclear power station. This treatment of the database screening criteria will systematically underestimate the airfield to background crash rate. This point has been covered in my original evidence LAAG/3/A para 53.

Bias Due To Incorrect Assignments In Crash Rate Data

69) The 2007 report and 2009 reports both admit that the background crash rate has been overstated compared with other international based models

'The en route accident rates derived from these wider data sets indicate that the background rate employed in the AEA Technology may be a little[17] *pessimistic, in particular of large aircraft accident rates.' (CD 13.9, Page 11, 3rd paragraph)*

[17] The term 'a little' is misleading. The discussion on pages 10 and 11 of the report shows it to be almost twice that of the comparable data set in USA, almost 4 times that of the CAA's worldwide estimates for civil aviation crashes in a similar period and almost 9 times that of the more relevant large transport aircraft crashes

70) This paragraph goes on to say

It also indicates a much lower background rate for commercial civilian airline operators' ESRT later admits that military back ground crash rates have little relevance to operations at LAA.

In fact our evidence shows that both civil and military large aircraft, have been wrongly listed within the AEA data base.

71) The original assessment had only four large transport aircraft crashes within the background crash rate data base: two commercial (Boeing 747 at Lockerbie in 1988, Viscount 800 near Uttoxeter in 1994) and two military (Shackleton on the Isle of Harris and Hercules near Blair Atholl).

All of these have been incorrectly listed bringing the actual background crash rate for large transport aircraft in the UK to zero during that period.

72) The ESRT 2007 report (CD 9, Page 10, first paragraph) agrees with my evidence (LAAG 3/A/ para 53) that Lockerbie should not have been included within the background crash rate as it was an act of terrorism[18] not an accident.

73) It then states that

In addition, the single civil large transport aircraft crash seems somewhat unrepresentative of the majority of traffic, involving a relatively old turboprop driven Viscount that developed problems en route with 3 out of its 4 engines. The aircraft was seeking to make an emergency landing and was evidently still under some degree of pilot control, On that basis there is a case to be made that this accident might have been excluded in the derivation of the background crash rate. Although the aircraft impacted the ground some distance from the airport to which it was seeking to divert it seems that there may have been sufficient control by the pilot to avoid a prohibited zone.

Confirming that this event should not have been included in the background data base. The ESRT report goes on to say:

74) *Therefore excluding incidents due to terrorist attacks, we identify no en route accidents in UK involving civil large aircraft movements in the 15 year period from*

---

assessed by Boeing since 1959, going back to a time when ESRT admits aircraft reliability per movement was significantly worse than today.

[18] No consideration has been made of the increased probability of a major nuclear accident resulting from terrorism.

1985 to 2000 in which no pilot control of the aircraft as available, indicating the very low rate of catastrophic en route failure for modern civil airlines.

As far as we can ascertain, there have been no large en route accidents in UK since 2000 so this statement can be updated to state that there have been none within the last 25 years.

75) It is not known whether any large military aircraft crashes have been included in the background crash rate since 2000 (information not provided). However the two which were listed in the 1985 to 2000 period were wrongly assigned as:

-The Shackleton on the Isle Of Harris was a failed attempt to land the aircraft at Benbecula airport in bad weather and so clearly not an en route event (Accident report in Appendix 1)

-Although the Hercules at Blair Atholl had travelled up from Lyneham it was actually flying a low level training sortie, practicing a package drop, when it crashed. (Accident report in appendix 2). Therefore it cannot be considered as a normal en route crash.

76) It should be noted that the effect of these incorrect listings is doubled when considering the skew placed up on the background to airfield crash rate ratio; at least in the Isle of Harris and Uttoxeter cases, where these events should have been included within an airfield related data base.

77) The ESRT2007 report admits on page 9 that the Dungeness site lies a considerable distance from 'areas of high crash concentrations' for military aircraft so one could expect the civilian background rate to be more relevant.

78) It admits that there have been no large civilian aircraft en route crashes in the UK since 1985 and the only two military ones listed were, in any case, wrongly assigned[19].

79) As it is the larger aircraft which are more likely to induce a catastrophic outcome on collision[20], the NII can no longer assert that the risk posed by en route traffic is greater than that which would be introduced by an expansion of Lydd Airport when clearly the reverse is true.

SUMMARY

80) Both the 2007 and 2009 reports generate an impression that ESRT is seeking ways to support NII's original conclusions rather than carrying out a fully independent and objective review.

[19] At least in the period upto 2000 where we have access to data
[20] Bearing in mind that Risk = probability x **severity of outcome**

81) ESRT admits that none of the models under consideration can generate a meaningful estimate of the probability of an aircraft crash derived from Lydd based traffic due to its curved/non-algined flight paths and numerous operational constraints. It admits that the introduction of large aircraft taking off and landing at LAA could result in a crash which penetrates the bioshield resulting in a significant off site radiological release. It admits, in its closing statement (CD13.9, page 31, last sentence), that '*In summary we identify no obvious scope for implementation of operational procedures that would mitigate the risk of aircraft crash at the Dungeness Nuclear Site.'*. In other words, these are fundamental problems for which there is no fix. Yet, throughout its reports, ESRT tries to rationalise away each difficulty, one by one, instead of following NII guidelines which require the assessor to look at the system as a whole:

Risk should be assessed in an integrated manner. It is important to consider the 'full picture' when assessing risk and not a partial view from considering hazards in isolation, or in a slice of time, or location by location rather than across the whole system'(Principles and guidelines to assist HSE in it's judgements of ALARP, paragraph 17)

81) This supplementary evidence has demonstrated:

-A complete failure to take account of the exceptional birdstrike risk associated with this location. Neither report mentions the adjacent wetland conservation area or the fact that the whole area is under one of the largest migratory bird routes in Southern England.

-A failure of the standard crash rate models to represent curved and non aligned flight paths which dominate flight activity at LAA.

-Failure of the standard model to account for any landings on runway 21, despite the fact that these represent the majority of landings at the airport.

-The CAA confirms that conditions at LAA are conducive to a higher number of go arounds on runway 21. ESRT admits that runway 21 go arounds represent a higher probability of an aircraft crash onto the nuclear site, yet they are not accounted for in number or complexity. No further assessment of this hazardous procedure was taken in the 2009 review.

-ESRT admits that the crash rate models will underestimate the risk posed by curved approach landings onto runway 03 in which the aircraft is pointing directly towards the nuclear site.

-ESRT admits that the current 5 degree ILS offset angle will increase the probability of an aircraft, which has missed the runway 21 approach,flying closer to the nuclear power stations. ESRT was not aware, at the time of writing these reports, that this increased risk has been exacerbated by the introduction of an RNAV option which has a significantly larger offset of 14 degrees.

-ESRT is mistaken in its assumption that the standard model doesn't make allowance for pilot avoidance. The original data screening criteria means that the model makes full allowance which is one of its fundamental flaws.

-The skidding risk is not factored into the numerical assessment, this alone could bring the probability of an aircraft collision above any relevant safety marker.

82) Moreover, these reports indicate that ESRT has failed to stand back and take a common sense view of whether it is realistic to suggest that the 'ambient' back ground crash risk would dominate in this case.

It admits that there have been no en route large commercial transport aircraft crashes since 1985. It admits that en route large military transport aircraft are not relevant for this area (in any case our evidence shows that the two large military aircraft crashes which were in the background data base had been wrongly assigned). We have also demonstrated that the model generates a systematic bias which serves to overstate the ratio of background to airfield crash risk.

83) So to suggest that there is a greater chance of an aircraft dropping out of the sky onto the site than one which is undertaking complex take off, landing and low level flight manoeuvres through a bird conservation area located next to the nuclear power stations is simply not credible.

CONCLUSION

In conclusion and in support of our original evidence:

83) These two reports provide overwhelming evidence of the inability to model the probability of an aircraft collision with the Dungness nuclear power stations and a failure to account for the increased risk associated with the developed case.

84) The NII cannot claim, with any degree of certainty, that the increased risk posed by an expansion of LAA would fall within acceptable levels. Our analysis clearly demonstrates that it outweighs any background risk posed by aircraft flying overhead.

85) Recent events in Japan have shown that the unthinkable can happen. Earthquakes are not within the Secretary of State's control but planning applications are. Approval of plans which knowingly increase the probability of such a catastrophe cannot be justified to society. We therefore urge the Secretary of State to 'Err on the side of caution where there is uncertainty and where the safety of the general public is concerned' and refuse these two planning applications.

Trudy Auty